lagoonal environment (Hardie and Eugster, 1971) were found. Instead, all evaporitic textures in unit 1 are comparable to those described by Butler *et al*. (1982) from the lower supratidal to upper supratidal (Gypsum Mush Facies to Upper Salt Flat Facies) from the Recent of the Trucial coast (Text-fig. 5.9; Table 5.1).

The thick bedded and massive to laminated gypsum (facies A5a) for which there is no Persian Gulf analogue, appears to represent the amalgamation of chicken-wire gypsum nodules.

Unit 1 Summary

The succession of facies in each rhythm in unit 1 can be directly related to those facies observed on a surface transect going from the shallow subtidal to the supratidal of the Recent Trucial Coast. Each unit 1 rhythm represents vertical stacking of these juxtaposed facies belts, hence each rhythm is interpreted as a shallowing-upward sequence.

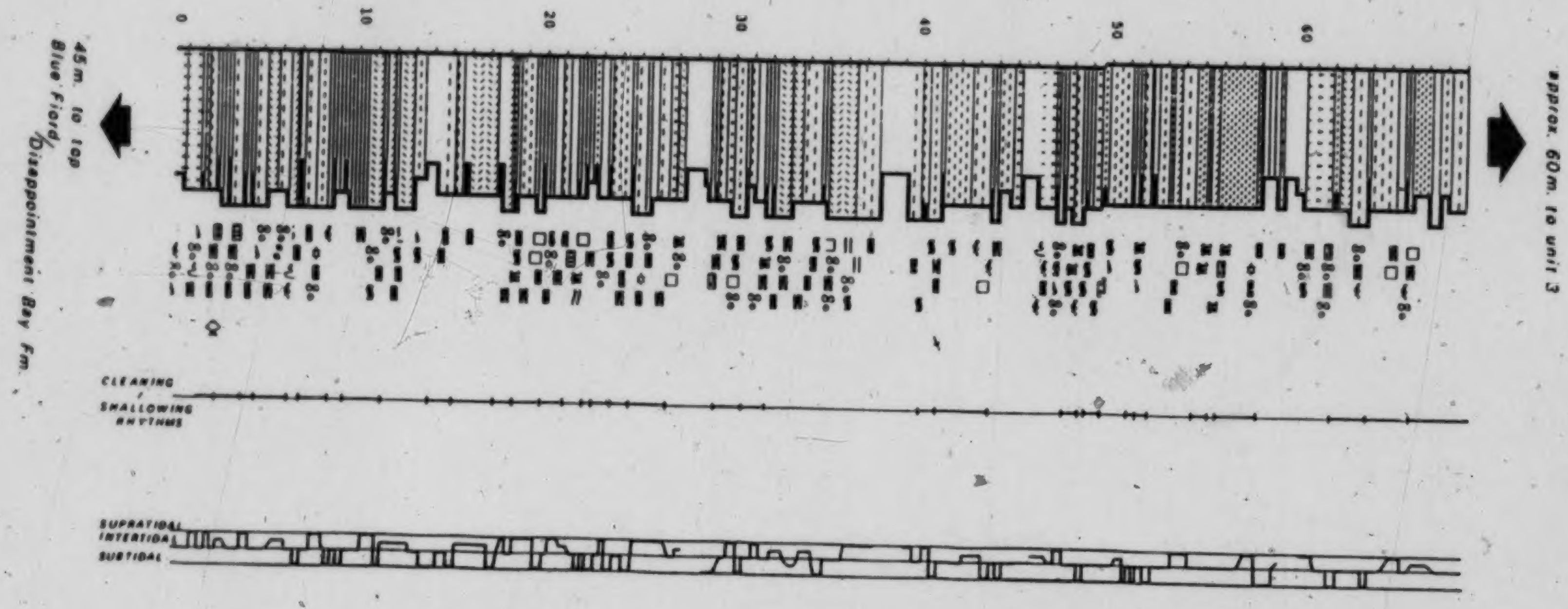
Wood and Wolf (1969) compared facies present in the Arab/Darb Formation of Abu Dhabi to lithologies and environments of the nearby modern setting. They recognized nine regressive sabkha rhythms from the rock record and proposed an ideal model of sabkha facies succession. In this model the lateral sequence of four facies from lagoon to salt flat in the modern situation (subtidal carbonate sand, lagoonal carbonate mud, intertidal algal mat and supratidal dolomite/aragonite and evaporites) was expressed vertically in cores of the Recent sabkha and in the Arab Dharb Formation by the diachronous extension of the coastal flats.

The repetitive nature of the unit 1 rhythms (Text-fig. 5.5) is similar to the repetitive sequences described by Wood and Wolf (1969). Member A unit 1 represents repeated progradation of intertidal and supratidal sabkha deposits over lagoonal facies.

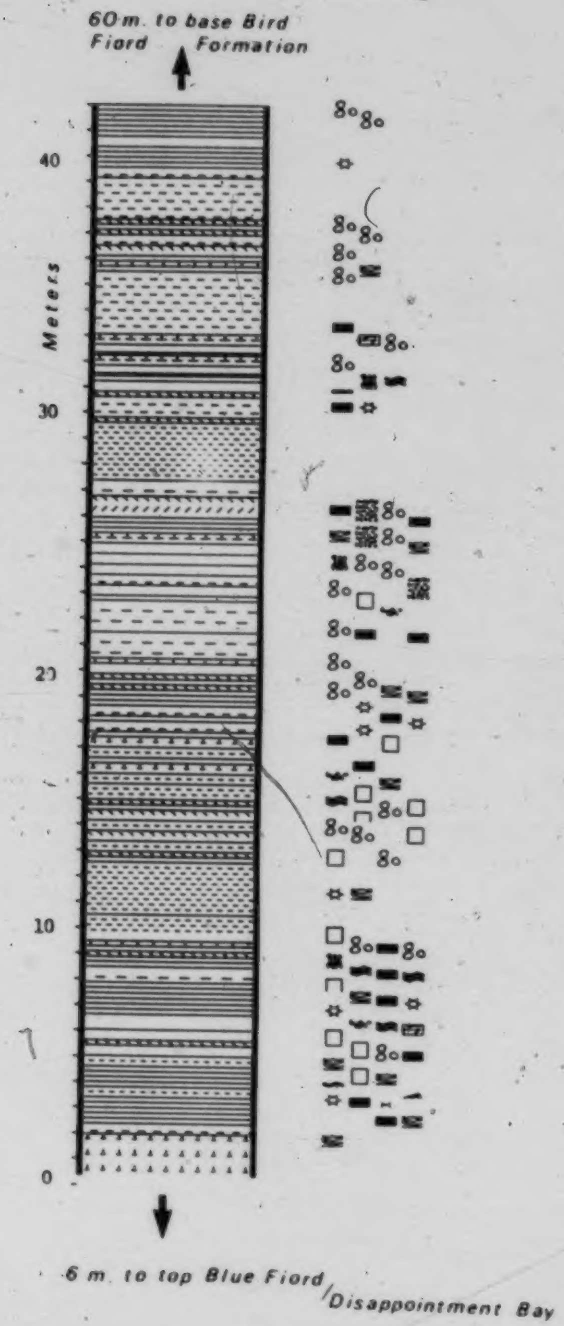
Unit 2

Description

Unit 2 comprises intercalated shales, siltstones, impure dolostones, rare limestones and very rare evaporites. Red mudstones and siltstones increase in frequency within the unit eastward from the transition with unit 1. The most westerly occurrence of these red deposits is in section 82A3, northwest of the head of Muskox Fiord. A near-complete section of the unit is exposed in cliffs bordering an ice-dammed lake northeast of the head of Baad Fiord. This section (Section 83B: Text-fig. 5.10) is chosen as a reference section for unit 2. Unit 2 is laterally equivalent to unit 1 to the west. Eastward, unit 2 grades into the less carbonate, more clastic, conspicuously red coloured lower tongue of the Strathcona Fiord Formation (section 83GRF1). This transition occurs between Baad Fiord and Grise Fiord. Section 83GRF1 (Text-fig. 5.11) is assigned to the Strathcona Fiord Formation due to its mainly clastic composition and overall red weathering tones when seen from


approx. 60m. to unit 3
0
10
20
30
40
50
60
45m. to top
Blue Fiord/Disappointment Bay Fm.
CLEANING / SHALLOWING RHYTHMS
SUPRATIDAL
INTERTIDAL
SUBTIDAL

Text-figure 5.10: Reference section unit 2 member A, Bird Fiord Formation (section 83B, Baad Fiord). Also showing cleaning/shallowing-up rhythms and associated sealevel curves. Symbol explanation in appendix.


60 m. to base Bird Fiord Formation
Meters
40
30
20
10
0
6 m. to top Blue Fiord/Disappointment Bay

Text-figure 5.11: Lower tongue, Strathcona Fiord Formation (section 83GRF1, Grise Fiord). Symbol explanation in appendix.

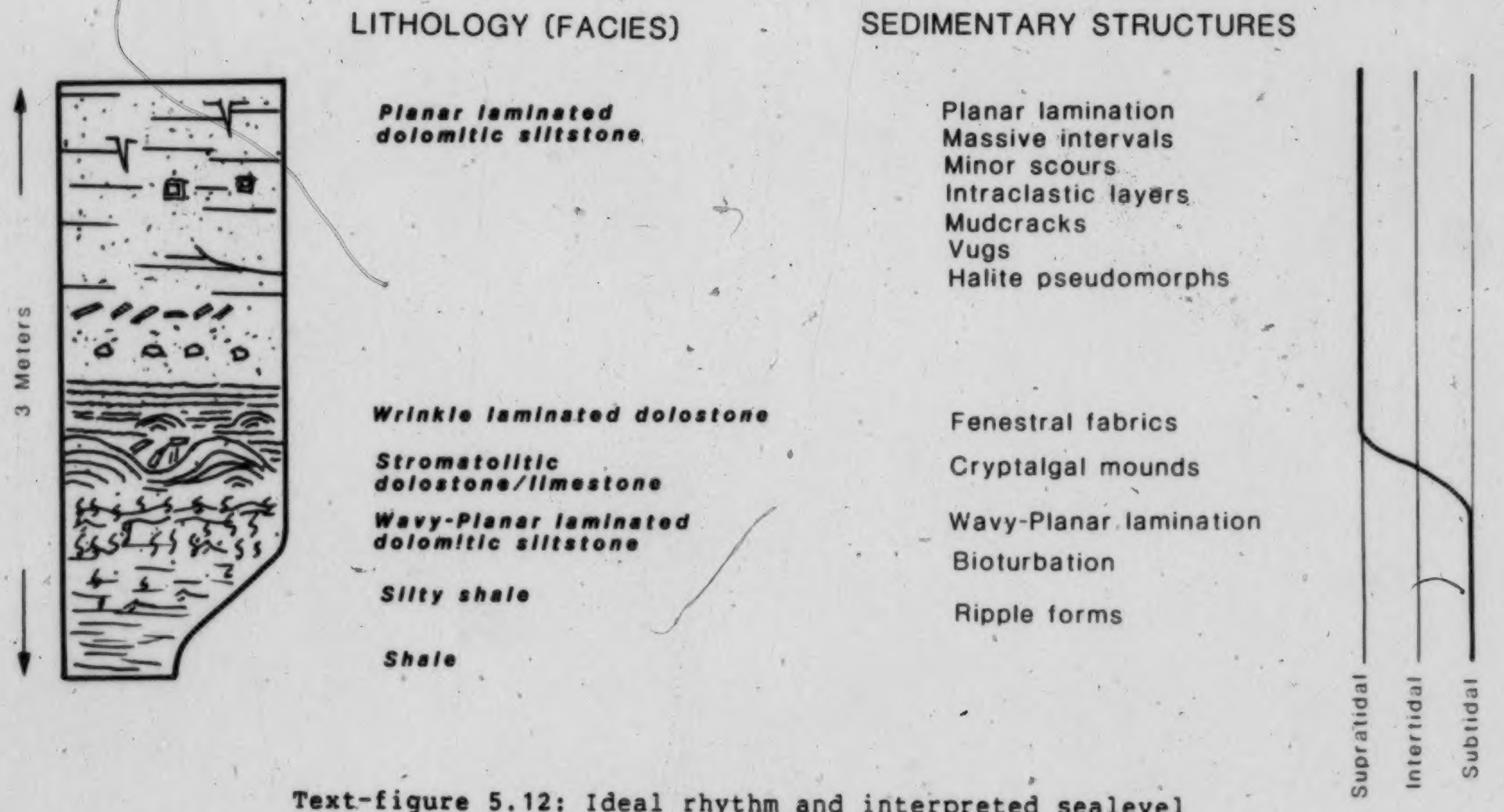
the air.

Unit 2, like unit 1, comprises repetitive cleaning-up rhythms. Unlike unit 1, the rhythms in unit 2, which rarely possess evaporites, are characterized by a greater clastic component (quartz silt) and a thicker development of stromatolitic dolostones with rare stromatolitic limestones (Text-fig. 5.12).

Unit 2 rhythms commonly show evidence of bioturbation (mottled red and green siltstones, dolomitic siltstones and silty dolostones) in rocks juxtaposed between the shale base and the carbonate dominated tops. Stromatolitic dolostones and rarer limestones commonly overlie this and are in turn overlain by planar laminated and/or massive bedded dolostones/silty dolostones/dolomitic siltstones. Evaporites, when present, occur either as vug-fill in the massive bedded facies, or as halite pseudomorphs in the planar laminated facies. Non-evaporitic sedimentary structures (rippling, runzel marks, planar to wavy lamination, planar lamination, mudcracking, small scale scouring etc.) have a similar distribution in the rhythms as they do in unit 1.

Unit 2 Interpretation and Summary

The similarity of the lower portions of the rhythms in units 1 and 2 suggests similar environments of deposition and patterns of environmental succession. The general absence of evaporites or evaporitic textures in unit 2


LITHOLOGY (FACIES)
SEDIMENTARY STRUCTURES
3 Meters
Planar laminated dolomitic siltstone
Wrinkle laminated dolostone
Stromatolitic dolostone/limestone
Wavy-Planar laminated dolomitic siltstone
Silty shale
Shale
Planar lamination
Massive intervals
Minor scours
Intraclastic layers
Mudcracks
Vugs
Halite pseudomorphs
Fenestral fabrics
Cryptalgal mounds
Wavy-Planar lamination
Bioturbation
Ripple forms
Supratidal
Intertidal
Subtidal

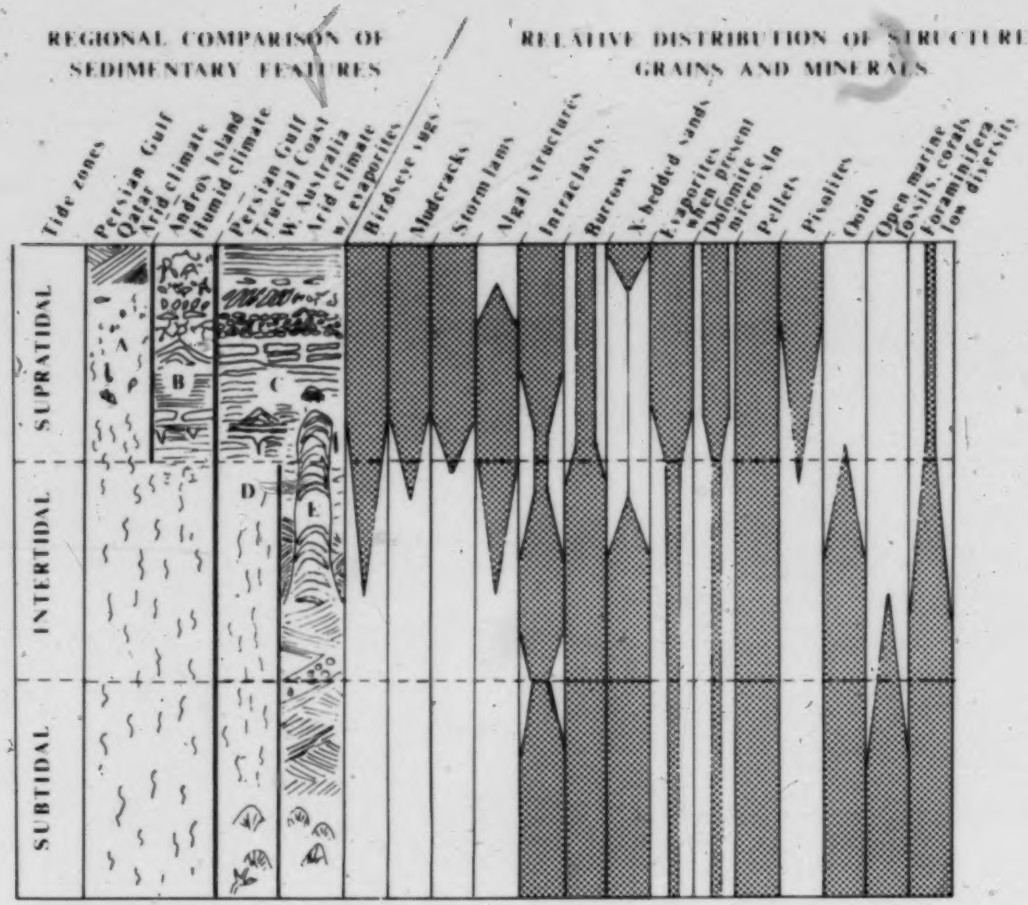
Text-figure 5.12: Ideal rhythm and interpreted sealevel curve, unit 2 member A Bird Fiord Formation.

resulted from supratidal deposition under different environmental conditions than prevailed for unit 1. There is little evidence of leaching of evaporites in the unit. Shinn (1983 p. 209) attempted a compilation of all facies variations associated with recent tidal flat accumulations. This compilation emphasized the importance of climatic features such as rainfall and humidity to the development of intertidal algal zones and of supratidal evaporites (Text-fig. 5.13). Kinsman (1976) emphasized the potential importance of the relationship between the mean atmospheric relative humidity and the depression of equilibrium water vapour pressures exerted by brines by stating (Kinsman, 1976 p. 273):

> '...there may be a relationship between the mean atmospheric relative humidity of a location and the maximum salinity of a brine and therefore between this parameter and the ultimate evaporite mineral facies developed.'

Similar variation in the tidal flat rhythms to that between unit 1 and unit 2 are apparent in Recent tidal flat settings in the Persian Gulf (Text-fig. 5.13). Lack of development of evaporites and the expanded development of shallow subtidal to intertidal algal facies in unit 2 over unit 1 appears to have been related to climatic changes (also possibly groundwater changes) between the two areas of deposition.

Unit 2, like unit 1, is composed of stacked shallowing-up rhythms. These represent repetitive progradation of intertidal and supratidal facies over


REGIONAL COMPARISON OF SEDIMENTARY FEATURES
RELATIVE DISTRIBUTION OF STRUCTURES: GRAINS AND MINERALS
Tide zones
Persian Gulf Qatar Arid climate
Andros Island Humid climate
Persian Gulf Trucial Coast W. Australia Arid climate w/ evaporites
Birdseye vugs
Mudcracks
Storm lams
Algal structures
Intraclasts
Burrows
X-bedded sands
Evaporites when present
Dolomite micro-Xln
Pellets
Pisolites
Ooids
Open marine fossils, corals
Foraminifera low diversity
SUPRATIDAL
INTERTIDAL
SUBTIDAL
A
B
C
D
E

Text-figure 5.13: An attempt to compile all commonly accepted facets of facies variations associated with carbonate tidal flat accumulations. **A** shows the sequence on tidal flats around the Quatar Peninsula in the Persian Gulf. Note lack of a well developed algal mat or anhydrite zone due to slightly higher rainfall than on the Trucial Coast. **B** shows sedimentary structures, such as soil clasts, current-deposited intraclasts. minor algal heads and domes, mud polygons and mudcracks, developed in humid climates such as Andros Island in the Bahamas. C shows sedimentary features associated with arid tidal flats, such as on the Trucial Coast in the Persian Gulf or in the Shark Bay region, western Australia. Note that the major difference in the last case is the presence of nodular chicken-wire anhydrite. The intertidal zones can range from oxidized muds to **D** coral reefs to **E** rippled crossbedded sands containing large club-shaped algal structures. The right-hand section is an attempt to show relative abundance of various sedimentary structures, grains, minerals and fossils. **FROM SHINN, 1983.**

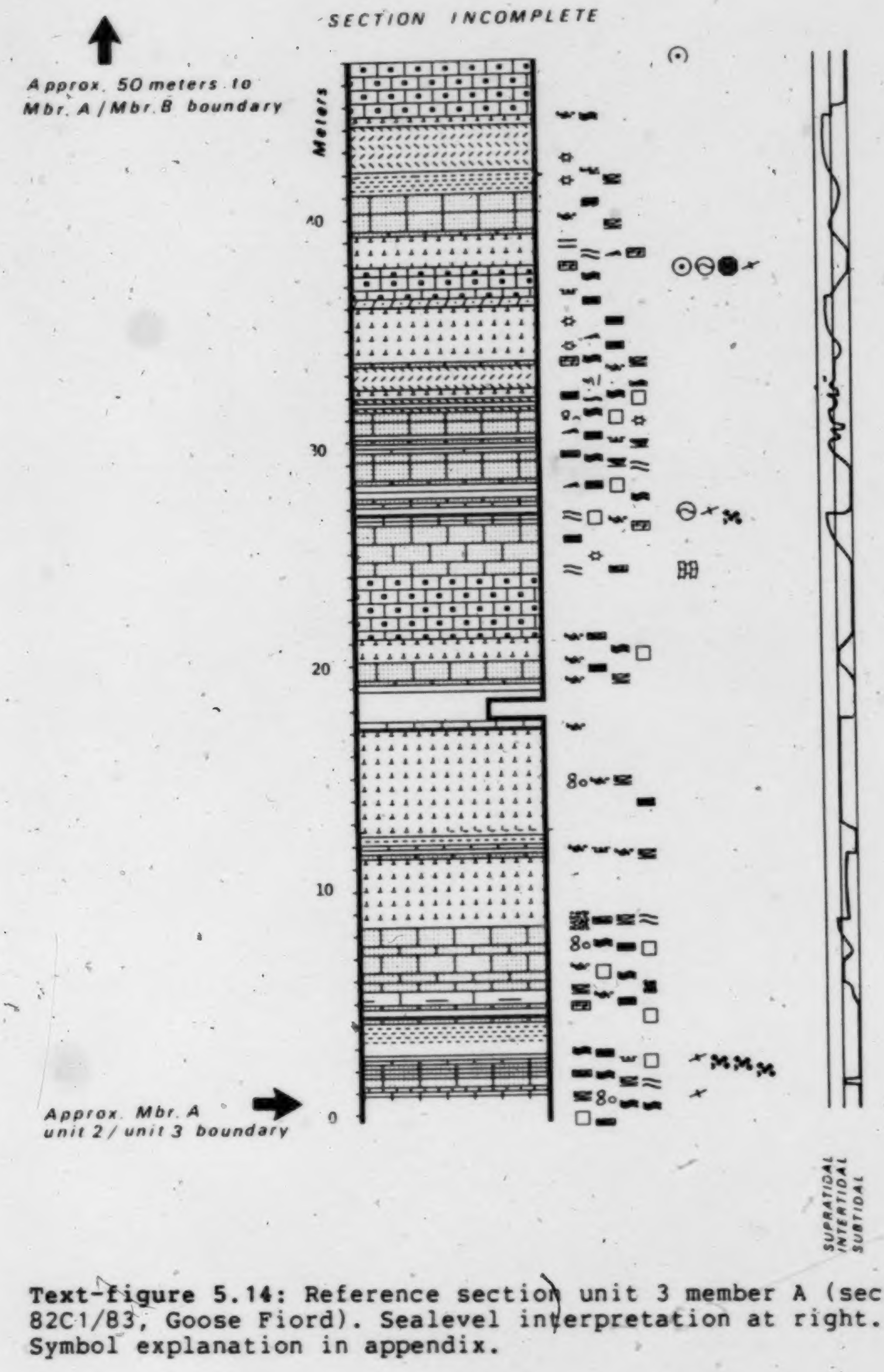
subtidal facies.

Unit 3

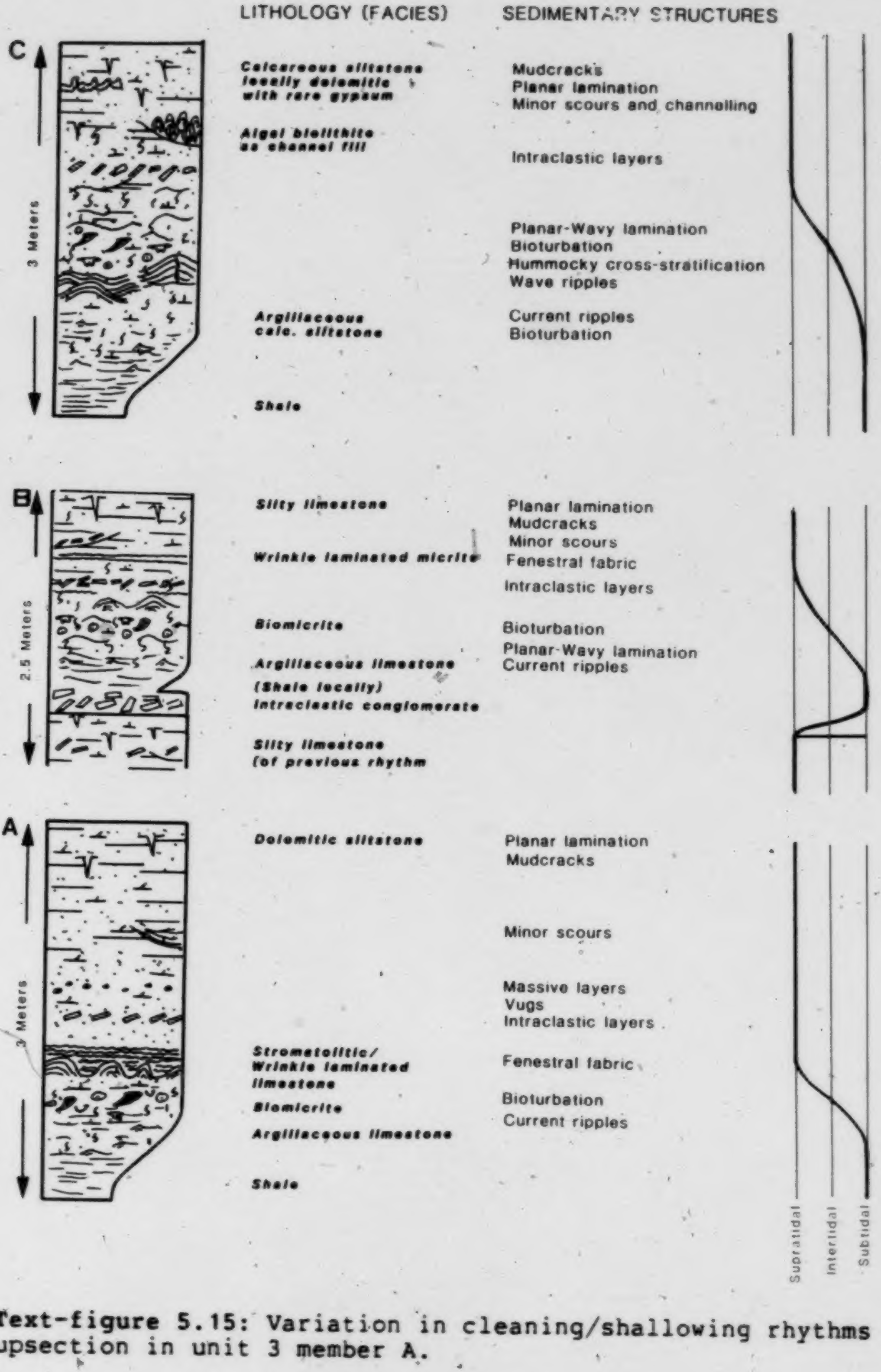
Description

Unit 3 is characterized by the presence of bioclastic limestones. This unit is best exposed in section 82C1 and its subsection 82C1/83 on the east side of Goose Fiord where it is about 75 meters thick. Section 82C1/83 (Pl. 13; Text-fig. 5.14) is chosen as a reference section. The unit overlies units 1 and 2 of member A. This boundary is gradational and is marked by the introduction of bioclastic limestones. Silty dolostones are volumetrically the most important lithology at the base of the unit. Limestones increase up unit, unit 3 grading upward into the rubbly impure limestones of member B.

Unlike units 1 and 2, unit 3 cannot be characterized by a single sedimentological style. The lowest 20-30 meters of unit 3 are composed of rhythms similar to those characteristic of unit 2, but differ in the local presence of bioclastic limestones (ostracods, calcispheres and stick corals) between the subtidal shales and the intertidal to supratidal planar laminated, mudcracked, variably intraclastic and rippled, dolomitic siltstones capping the rhythms (Text-fig. 5.15a). Evaporites occur rarely in the upper portion of these rhythms as thin enterolithic gypsum layers, infillings to vugs and fenestrae, and even more rarely as isolated small (<0.5 centimeters) gypsum crystals.


SECTION INCOMPLETE
Approx. 50 meters to
Mbr. A / Mbr. B boundary
Meters
40
30
20
10
0
Approx. Mbr. A
unit 2 / unit 3 boundary
SUPRATIDAL
INTERTIDAL
SUBTIDAL

Text-figure 5.14: Reference section unit 3 member A (section 82C1/83, Goose Fiord). Sealevel interpretation at right. Symbol explanation in appendix.


LITHOLOGY (FACIES)
SEDIMENTARY STRUCTURES
C
3 Meters
Calcareous siltstone locally dolomitic with rare gypsum
Algal biolithite as channel fill
Argillaceous calc. siltstone
Shale
Mudcracks
Planar lamination
Minor scours and channelling
Intraclastic layers
Planar-Wavy lamination
Bioturbation
Hummocky cross-stratification
Wave ripples
Current ripples
Bioturbation
B
2.5 Meters
Silty limestone
Wrinkle laminated micrite
Biomicrite
Argillaceous limestone
(Shale locally)
Intraclastic conglomerate
Silty limestone
(of previous rhythm
Planar lamination
Mudcracks
Minor scours
Fenestral fabric
Intraclastic layers
Bioturbation
Planar-Wavy lamination
Current ripples
A
3 Meters
Dolomitic siltstone
Stromatolitic/
Wrinkle laminated limestone
Biomicrite
Argillaceous limestone
Shale
Planar lamination
Mudcracks
Minor scours
Massive layers
Vugs
Intraclastic layers
Fenestral fabric
Bioturbation
Current ripples
Supratidal
Intertidal
Subtidal

Text-figure 5.15: Variation in cleaning/shallowing rhythms upsection in unit 3 member A.

These rhythms are gradually replaced upsection by a different style of repetitive rhythm (Text-fig. 5.15b). Shale is lost or reduced, the base of the rhythms instead consists of intraclastic variably impure limestone of transgressive origin. The remainder of each rhythm is regressive (Text-fig. 5.15b). This is superceded by planar to rubbly bedded micrites which locally are bioclastic. Bioclasts include crinoid ossicles, brachiopods, ostracods and stick corals. Much of the rubbly bedding is due to bioturbation. The uppermost portion of the rhythm locally exhibits mudcracking. The succession of sedimentary structures in the rhythms indicate that they are generally regressive in nature. However, the thin basal intraclastic interval is transgressive in origin.

The uppermost sixty meters of unit 3, exposed in sections 82B2 and 82B4, show a reduction in limestone and a corresponding increase in calcareous siltstones (Text-fig. 5.15c). These siltstones are locally slightly evaporitic, but generally show a high degree of bioturbation. Rare evaporite solution breccias are present. Rhythm style is similar to that in the lower portion of unit 3 (Text-fig. 5.15a), but with calcareous siltstone in the place of dolomitic siltstone/silty dolostones. Algal limestones (facies A2c) occur as small channel fill in the uppermost portions of some rhythms.

Many sedimentary structures common to units 1 and 2, and the lower part of unit 3, do not occur in the upper part of unit 3 (Text-fig 5.3). Structures unique to the upper portion of unit 3 include stacked wave ripples (Pl. 11, fig. 4). Variation in rhythm style in unit 3 is in part due to the increase of clastic material up unit.

Unit 3 Interpretation and Summary

Unit 3 deposition probably occurred in environments ranging from supratidal mudflats (facies A1b, A2f, some of facies A6), through the intertidal zone (facies A2b, c, d and e; some facies A6) to a subtidal setting (facies A4 and some facies A6). The general upsection increase in bioclastic limestone at the expense of unfossiliferous dolostones reflects a transgression. The incoming of fossil faunas and the increasing diversity of these faunas upsection is indicative of more open marine conditions.

Member A Summary

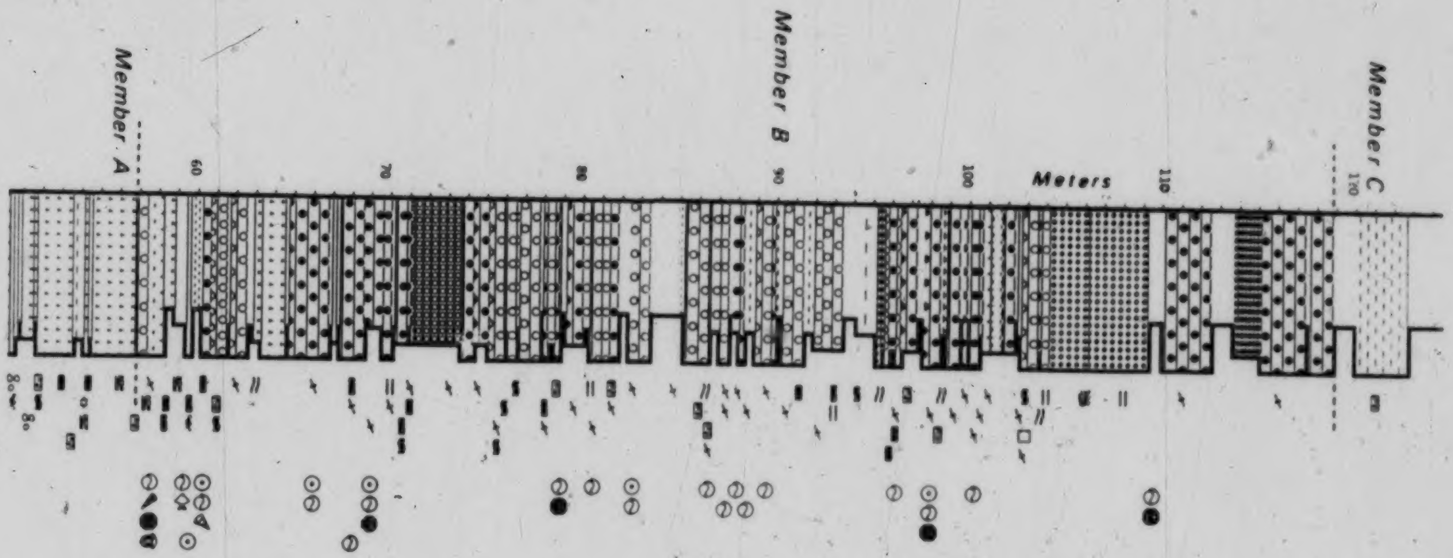
Member A represents evaporitic sabkha, carbonate mudflat and lagoonal environments. Upsection facies changes in this member reflect an overall rise in sealevel. On a smaller scale, member A is composed of repetitive aggradational sequences analagous to the PACs (punctuated aggradational cycles) of Anderson, Goodwin and Sobieski (1984). East-west facies changes reflect a slight clastic influx from an easterly direction.

C. MEMBER B

Introduction

The contact between members A and B is placed at the first occurrence of prominently weathering, rubbly bedded, sandy limestones. Member B is distinctive in the field and on air photographs because it is a cliff-former. The resistant, rubbly bedded, sandy limestones of this member are a significant physiographic feature between the head of Norfolk Inlet, Devon Island and the area north-west of Muskox Fiord, Ellesmere Island, where the member averages 60 meters in thickness. Member B is not distinguishable in poor exposures of the Bird Fiord Formation east of Baad Fiord, possibly due to facies changes. The member does not form a cliff in the Baad Fiord area, and appears to undergo facies change. The lowest 15 meters of section 83A are assigned to Member B on lithological grounds.

Member B is exposed discontinuously between Arthur Fiord and Cardigan Strait (Text-fig. 1.3). Excellent, but largely inaccessible, exposures are present in cliffs on the east and west coasts of North Kent Island and at Blubber Point, Southwest Ellesmere Island (Pl. 15 figs. 1, 2). Member B forms a prominent, discontinuous scarp between Blubber Point and Muskox Fiord. A complete section, selected as a reference section, outcrops in a cirque-like basin 10 kilometers north of the head of Muskox Fiord (section 82B4 - Text-fig. 5.16). This member was not recognised north of


Member A
Member B
Member C
Meters
60
70
80
90
100
110
120

Text-figure 5.16: Reference section member B (57-119 meter interval section 82B4, Muskox Fiord). Symbol explanation in appendix.

Grise Fiord. Either it does not outcrop, or the member dies out due to lateral facies change.

Member B west of Muskox Fiord, Ellesmere Island, is comprised of two resistant calcareous units separated by a more recessive argillaceous unit (Pl. 15, figs. 1, 2; Pl. 17). East of Muskox Fiord this three-fold division of the member is not readily apparent.

Facies Description

Four endmember lithotypes, shale, siltstone, sandstone and limestone, are present. Except in the case of shale, beds composed of pure endmember lithotypes do not occur. Most of member B is composed of mixtures of limestone, siltstone and sandstone.

Lithotype 1 -Shale

This lithology occurs as either thin planar shale beds (Pl. 14, figs. 5, 6), or discontinuous 'squeezed' shale as a matrix around rubbly bedded carbonates (Pl. 14, figs. 1, 2). Compaction of the shales, and their recessive nature, does not permit recognition of sedimentary structures.

Lithotype 2 -Limestones

Carbonates of member B contain at least 15% silt to fine sand-sized quartz grains, mica grains and rare feldspars. A continuous gradation from sandy/silty limestones to calcareous sandstones is present. Bioclastic content is ubiquitous, but variable in composition and volume. Impure limestones occur as:

Facies B2a. Rubbly biomicrite.

Planar bedded intervals of rubbly bedded biomicrites occur interbedded with thin shale and silt beds and laminae. This facies is divisible into two subfacies using the percentage of sand content present and amount and type of matrix between the biomicrite 'lumps':

Subfacies B2ai. Quartz sand/silt content <20% (Pl. 14, fig. 1). Thin shale 'sheaths' separate individual carbonate 'lumps' in this subfacies. This shale matrix forms 10-40% of rock.

Subfacies B2aii Quartz sand/silt content >20<35% (Pl. 15, fig. 8). Dark grey weathering limestone 'lumps' occur in a matrix of rust brown sandy dolomitic limestone/calcareous sandstone. The limestone 'lumps' are arranged in variably distinct planar layers. Commonly associated with this subfacies is an uprhythm increase in the ratio of 'lumps' to matrix leading to the eventual exclusion of the brown weathering sandier matrix (Pl. 15, fig. 8). Bioclasts include brachiopods, gastropods, crinoid ossicles and coral fragments.

Facies B2b. Planar bedded biomicrites.

The clastic quartz/mica content ranges from 15-20%. Bioclastic content is highly variable and consists of colonial and solitary corals, brachiopods, gastropods and tentaculitids. Most corals are not in life position.

25

Tentaculitids locally exhibit current orientation and brachiopod and crinoid hash is concentrated in coquinoid lenses. Bedding plane surfaces show horizontal and vertical bioturbation. Large horizontal bioturbation furrows (Pl. 15, fig. 5) commonly accompany abrupt basal contacts. This facies commonly occurs above facies B2aii, B3b and B4b and is distinguishable from them by its unmottled dark steel grey weathering colour.

Facies B2c. Chaotic sandy dolomitic biomicrites.

Intervals of this facies occur in planar bedded massive weathering units characterized by a lack of sedimentary structures. Bioclasts are not current sorted though they locally exhibit current bedding (Pl. 14, fig. 7). Sand content is 35-45%; the higher sand content and slight dolomitisation impart this facies with a brown weathering color. This differs from the characteristic dark grey color of facies B2b. Bioclasts include brachiopod hash, conical sponges and coral fragments.

Lithotype 3 -Siltstone;

Pure siltstone (Facies B3a) occurs in thin (5-10 centimeters thick) beds which can possess planar and/or ripple lamination.

Facies B3b. Argillaceous siltstone.

Commonly present at the base of 'rhythms' grading from argillaceous siltstone upwards to rubbly impure limestones or calcareous sandstones (Text-fig. 5.17).

Original bedding in most outcrops has been destroyed by bioturbation. Locally, indistinct wavy lamination and/or planar bedding (1.5 centimeters thick) gives rise to a flaggy weathering pattern to these outcrops.

Lithotype 4 -Sandstone

Pure orthoquartzitic sandstones are not present in Member B. Composition is highly variable, from very calcareous sandstones to impure limestones:

Facies B4a. Slightly calcareous fine sandstone.

15-30% of the total composition of the lithologies comprising this facies consists of $CaCO_3$, the remainder being quartz and rare feldspars. A relatively low degree of bioturbation (as compared to other facies in member B) permits the recognition of thin current lamination (planar to wavy) in flaggy weathering intervals.

Facies B4b Highly calcareous fine sandstone/sandy limestone.

Sandstones which contain 30-50% $CaCO_3$. This lithology occurs in two distinct subfacies;

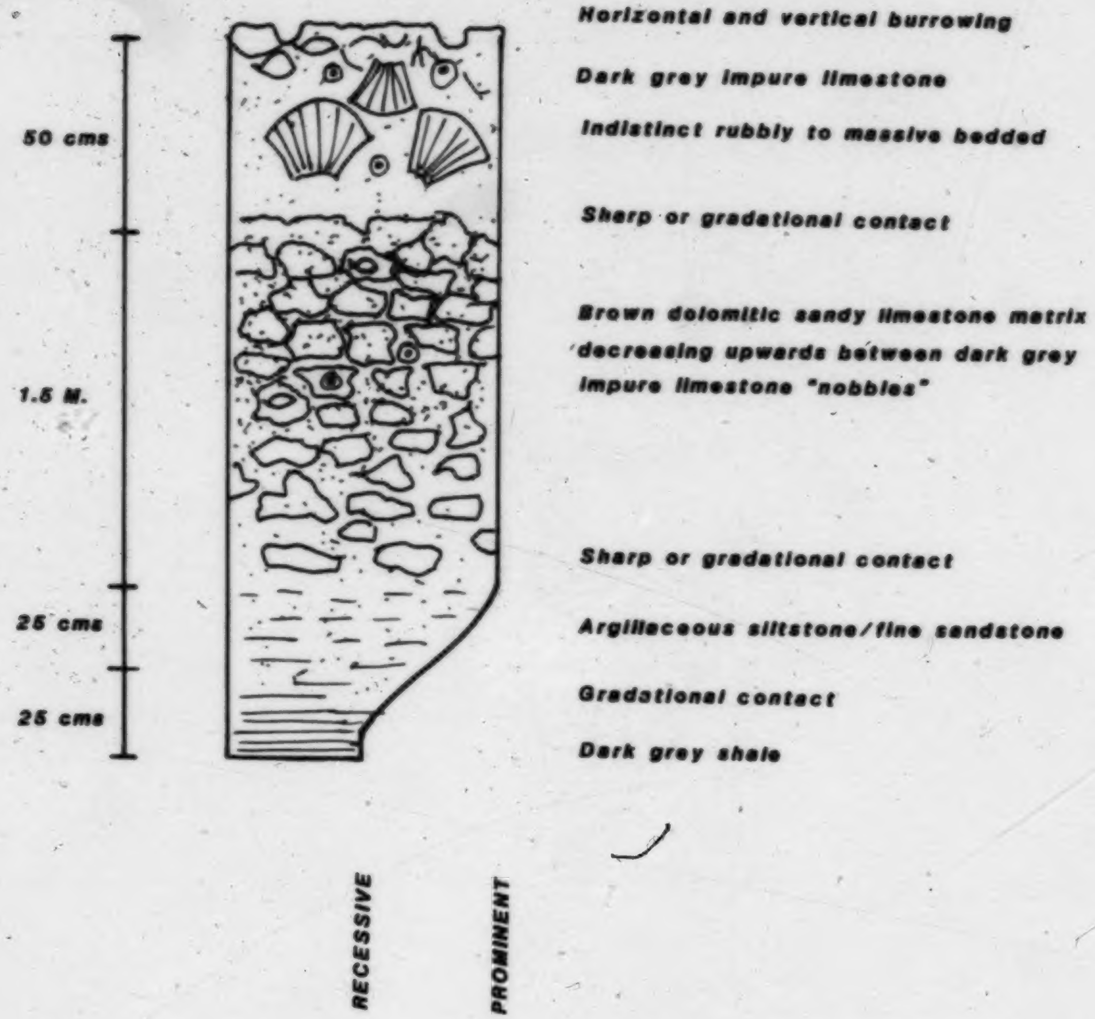
Subfacies B4bi occurs as a calcareous sandstone matrix to facies B2aii (Pl. 15, fig. 8). This subfacies is easily recognisable in the field due to the contrast between the brown weathering color of the calcareous sandstone/sandy limestone matrix and the enclosed dark grey impure limestone 'lumps'. This brown weathering colour is partly due to slight dolomitization of the calcareous component. Sedimentary structures are not preserved in most of the outcrops. Current activity is indicated by coquinoid (*Atrypa* sp., *Elythyna* sp.) lenses, rare ripple cross-laminae and ephemeral scour surfaces. Isolated colonial coral heads, both in life position and overturned, are associated with ungraded brachiopod hash.

Subfacies B4bii. Current bedded calcareous fine sandstone. This facies is most common in section 82A3 where current bedded calcareous sandstones replace rubbly bedded facies in importance. Bluff-forming calcareous sandstones at this locality exhibit planar lamination, interference ripples/ripple cross lamination (Pl. 16, figs. 4, 7), herringbone ripple cross lamination (Pl. 16, fig. 7), planar to asymptotic cross stratification and locally preserved megaripples. Bedding plane surfaces show small scale horizontal and vertical bioturbation (Pl. 16, Figure 6). Fossils are rarer in this subfacies than in subfacies B4bi; bioclasts include localised coquinas of brachiopods (*Elythyna* sp., *Atrypa* sp.), rare solitary and colonial corals, and 'pockets' rich in crinoid ossicles. Cliff exposures of member B at sections 79GF (Pl. 17) and 82B4 show large scale channels (width exceeding 30 meters; depth 9 meters) filled with cross bedded calcareous sandstones of this facies.

Interrelationship between facies

Commonly, outcrops exhibit planar interlayering of variably resistant, rubbly-bedded, calcareous sandstone and sandy limestone (Pl. 14, fig. 4; Pl. 15, fig. 7). The undersurfaces of these beds show large horizontal traces (Pl. 15, figs. 3, 4). A rhythmic pattern of facies succession is apparent in well exposed sections. These rhythms may be termed either coarsening-up or cleaning-up sequences due to an upward decrease in argillaceous content and an increase in sand-sized clastic grains. The ideal rhythm consists of a shale base which grades, through argillaceous siltstone/fine sandstone, to rubbly bedded sandy limestones/calcareous sandstones (Pl. 14, fig. 5; Text-fig. 5.17). These rubbly bedded facies commonly show an upward reduction in sand content (Pl. 15, fig. 8). The rhythm is usually capped by current-laminated, calcareous sandstones, the bases of which are locally chaotic. Corals are commonly overturned; bioclasts are not current sorted, nor are sedimentary structures apparent. These chaotic intervals grade up into a current-bedded, bioclastic sandstone cap. Bioclasts are common in the upper two thirds of each rhythm and commonly include brachiopods, bivalves, crinoid ossicles, corals and sponges. Rarer bioclasts include tentaculitids, gastropods and fish bones. 'Elythynid' brachiopods dominate the shelly fauna.

On North Kent Island, and southwest Ellesmere Island west of Muskox Fiord, three units are distinguishable in


Horizontal and vertical burrowing
Dark grey impure limestone
Indistinct rubbly to massive bedded
Sharp or gradational contact
Brown dolomitic sandy limestone matrix decreasing upwards between dark grey impure limestone "nobbles"
Sharp or gradational contact
Argillaceous siltstone/fine sandstone
Gradational contact
Dark grey shale
50 cms
1.5 M.
25 cms
25 cms
RECESSIVE
PROMINENT

Text-figure 5.17: Typical rhythm units 1 and 3, member B.

member B; however accessible exposure is limited to the prominent units. Brief observation of inaccessible sections by helicopter indicate that the dominant lithologies present in the recessive central unit are rubbly-bedded, impure carbonates in an argillaceous matrix (facies B1 and B2ai). The higher argillaceous content of this unit imparts a recessive weathering profile (Pl. 15, figs. 1, 2; Pl. 17).

Interpretation

The coarsening/cleaning upward sequences in member B are similar in scale (approximately 3 meters) and style (upward reduction in argillaceous content) to the rhythms in member A. The basal contact between the top of the preceeding rhythm and the shale base of the next is invariably sharp. The dark grey shale represents deposition under low energy conditions. Reduction in the shale content, and increase in the limestone/sandstone content up rhythm indicates a shallowing, or increase in energy. Variation in the quartz sand content with relation to the micritic limestone content probably reflects changes in supply from a clastic source in a 'limestone prone' setting. Lithological change up rhythm thus appears to indicate a relative shallowing and/or increase in energy followed by an abrupt deepening or loss of energy into the shale base of the succeeding rhythm.

Complete fossils, as well as bioclastic hash, are abundant in member B. Dominant faunal elements present include corals and brachiopods. *Elythyna* sp. comprises the majority of the shelly fauna (Pl. 15, fig. 6). Gastropods, bivalves, tentaculitids and sponges occur locally in abundance. Sparse conodont faunas were recovered (dominated by simple cones) from the purer limestones (facies B2b). The abundance and variety of the shelly fauna suggests fully marine conditions. Leão (1982) stated that the presence of siliciclastic sediment *per se* is not an inhibiting factor to coral growth in present western Atlantic settings. She argued that fresh water influxes, which usually accompany siliclastic material, is the major cause of stress on coral growth. The abundance and variety (see appendix) of the coral faunas in sandstones and sandy limestones in member B indicates an indirect source for the siliciclastic material -possibly by longshore drift or by storm redistribution.

Where not obliterated by bioturbation, the calcareous sandstones/sandy limestones of member B exhibit current lineation, planar lamination, ripple cross lamination, herringbone cross lamination, planar and asymptotic cross bedding, rare megaripples, and large scale channeling. These structures, in addition to overturned coral heads, unsorted bioclastic intervals, and thin lensoid coquinas of articulated and disarticulated shells, indicate variable current activity.

The overturned coral heads, and unsorted, sandy bioclastic beds, represent storm activity, as a result of which sessile faunas were disrupted. The chaotic intervals are commonly capped by current bedded calcareous sandstones with lensoid coquinas. Bedform succession in these storm-wane sequences grade from basal planar/hummocky lamination to megaripple cross stratification to current rippling (Pl. 16, fig. 8). Herringbone cross lamination in these current bedded sandstones indicates variation in current directions. Large scale cross stratification and associated scouring in bioclastic calcareous sandstone intervals represents migration and reworking of bar forms.

The most obvious sedimentary feature of member B is rubbly bedding. The uneven nature of the contact between successive beds in Member B can be shown, in most cases, to result from large scale horizontal burrowing. The bases of overturned blocks of rubbly limestone/calcareous sandstone show fillings of large horizontal furrows into the underlying argillaceous rocks. (Pl. 15, figs. 5, 6). It would appear that the recessive argillaceous layers separating the rubbly bedded horizons represent periods of relatively slow sedimentation during which biotic activity was intense.

While the nature of the bases of the rubbly bedded units can be attributed to bioturbation (Pl. 15, figs. 3-6), not all the rubbly bedding in these intervals was formed by this mechanism. Whereas many of the 'lumps' lie in planar layers as would be expected if horizontal bioturbation was the cause, the extreme variation in the size and the irregularity of the 'lumps' belies this explanation. Calcite filled cracks in some lumps (Pl. 16, fig. 2), apparent boudinaging of thin planar beds (Pl. 16, fig. 1), and 'squeezed' fabrics in the argillaceous matrix, indicate differential compaction as a factor in the formation of this texture.

Wobber (1967) attributed rubbly bedding in the Lias of south Wales to loading (an early post-depositional process) and to boudinaging and interstratal sliding (late post-depositional processes). Wanless (1979) attributed nodular structure in carbonates to pressure solution. Pratt (1982) questioned Wanless' (1979) conclusion of pressure solution rather than differential compaction for the formation of a rubbly texture. The lack of loading features and of obvious pressure solution features (truncation of fossils) indicates that pressure solution was not a major factor in the formation of a rubbly texture in member B of the Bird Fiord Formation.

The presence of calcite-filled cracks in 'lumps' in some of the rubbly horizons attests to compaction of the sediment while it was in a semi-lithified state. The timing of the calcite fill is unknown, though it definitely post-dates semi-lithification of the lumps and the dolomitization of the matrix to the lumps (as calcite, rather than dolomite, is the crack-filling mineral). Jones *et al.* (1979) concluded that a similar rubbly texture in the Silurian Read Bay Formation resulted from subtidal lithification that occurred at a very early stage after deposition. In both the Read Bay Formation and in member B of the Bird Fiord Formation the 'lumps' show little evidence of compaction whereas the matrix shows considerable evidence of this - especially where the matrix is argillaceous. Also common to the Read Bay Formation and Member B of the Bird Fiord Formation is the selective dolomitization of the matrix compared to the 'lumps'. This suggests that the undolomitised 'lumps' were cemented and tight compared to the permeable matrix at the time of dolomitization.

Lithification is common 5-10 centimeters below the sediment surface in shallow marine carbonates in the Persian Gulf (Shinn, 1969; Taylor and Illing, 1969). Under subtidal conditions continuous sheets of lithified limestone are formed (Shinn, 1969); under intertidal conditions lumps are formed (Taylor and Illing, 1969). Comparison of these recent examples to member B of the Bird Fiord Formation suggests that member B was deposited in shallow intertidal to subtidal settings.

Member B Summary

Member B was deposited in a shallow nearshore setting. The presence of large channels indicates either a large lagoon or semi-enclosed bay in which tidal flow would be concentrated and tidal channels would form in response to this restriction. However, the predominantly planar bedded nature of the member, and the general lack of large scale cross-stratified intervals, suggests a lack of significant sediment migration due to tidal currents. The coarsening/cleaning upward rhythms represent shoaling sequences which may or may not be associated with sea-level changes in a nearshore setting. The sheet-like geometry of the bioclastic sandstones/sandy limestones, and the sedimentary structures in these intervals, suggests that storm processes were a major factor in sediment distribution. The general lack of storm bedforms such as hummocky-cross-stratification (Walker, 1982, 1984; Dott and Bourgeois, 1982) may be due to the sea bed having been above fair weather wave base, subject to constant reworking by wind induced currents, to a lesser extent by tidal currents, and by intense biotubation. A possible modern analogue to the depositional setting of member B is the mixed clastic/carbonate western part of Florida Bay.

D. MEMBER C

Introduction

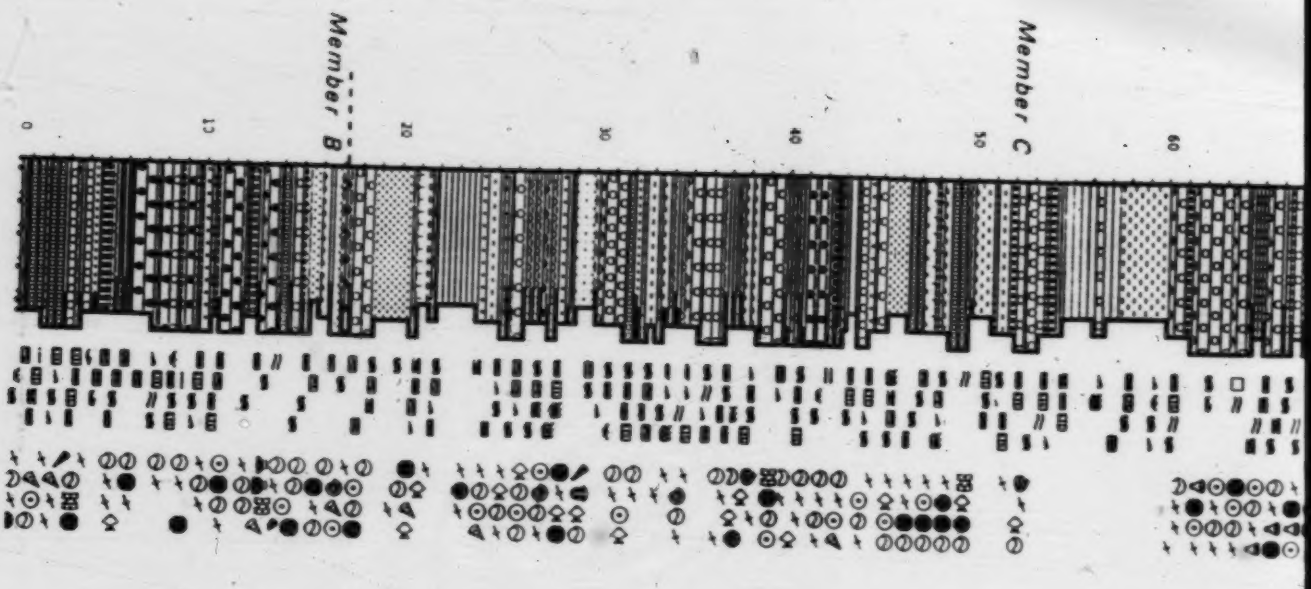
Member C, on average 60 meters thick, is recessive, weathering to a gently undulating terrain. A characteristic striping of this terrain seen in air photographs is due to resistant sandstones alternating with more recessive argillaceous lithologies. The contact between members B and C is taken at the first occurrence of clastic-dominated coarsening-upward rhythms. The contact between members B and C marks the level where the Bird Fiord Formation changes from being mainly carbonate in composition to being mainly siliciclastic. The increase in shale content at the member B/C contact results in a significant change in slope. Sections of member C are usually about 50% exposed (viz. sections 82C, 82C1). However, a fully exposed section through the member (section 83A) exists northwest of the head of Baad Fiord. This section is chosen as the reference section for member C. The following description of member C is based on observations made at this exposure (section 83A; Text-fig. 5.18; Pl. 18) and at section 82C (Goose Fiord). Recent retreat of the nearby ice-cap has left a stepped section with 100% vertical, and considerable lateral, exposure. The strike exposure permits examination of large scale features (Pls. 18, 21) which are not recognizable in more poorly exposed stream sections due to their size, and their occurrence in recessive lithologies.

Facies description

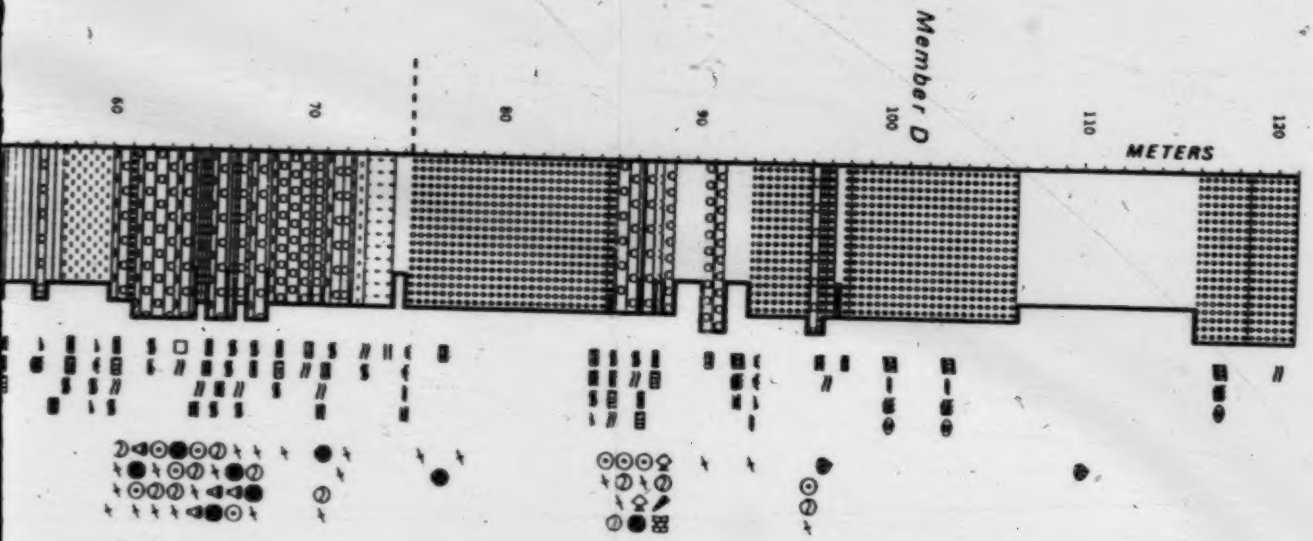
Four endmember lithotypes are present in Member C - shale, siltstone, sandstone and limestone. Limestone occurs only in the form of coral/sponge biostromes.

Lithotype 1 -Shale

Shale is gradational into siltstone by an increase in content of silt-sized clastic particles. Due to differing facies relationships between pure shale and silty shales it is necessary to separate these argillaceous lithologies into two separate facies:


Member B
Member C
0
10
20
30
40
50
60

Text-figure 5.18: Reference sections
(section 83A, Baad Fiord). Symbol ex


Member D
60
70
80
90
100
110
120
METERS

erence sections for members C and D
rd). Symbol explanation in appendix.

2of2

Facies C1a. Pure shale.

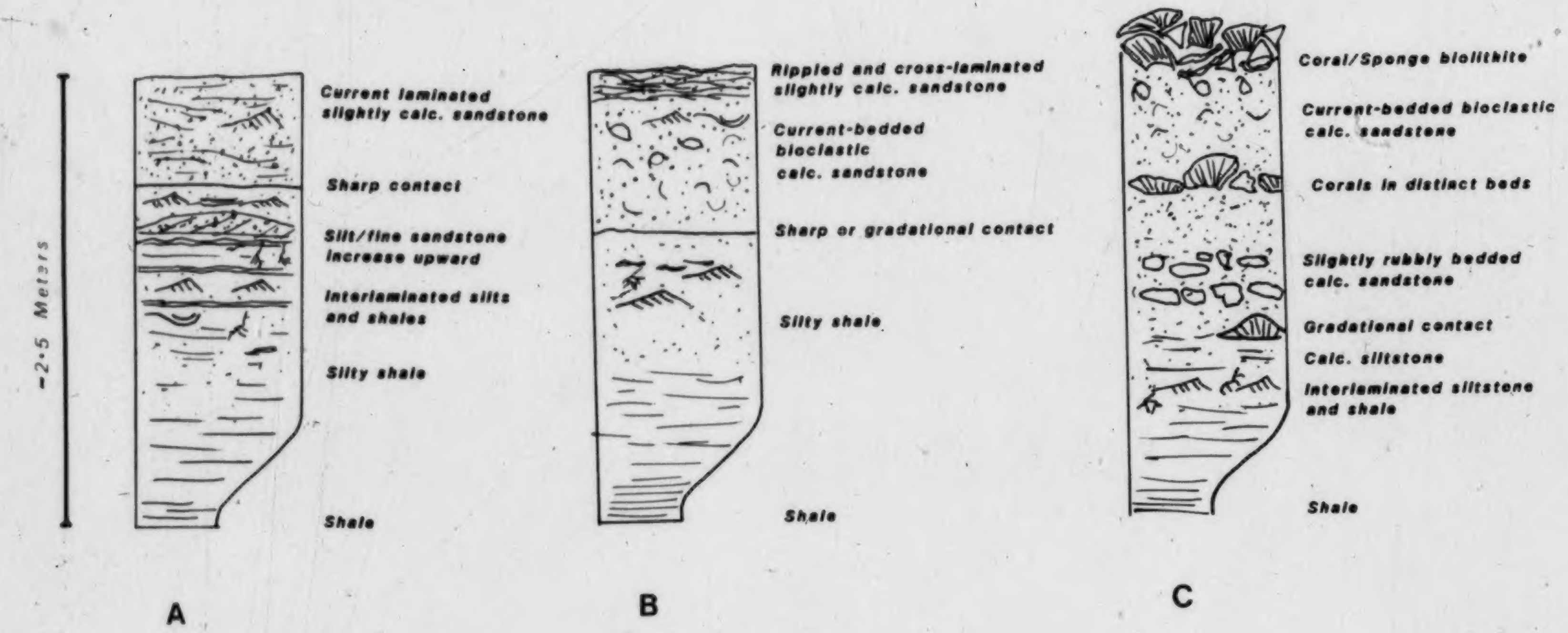
Pure shale occurs in planar, laterally continuous horizons abruptly overlying facies C3 and C4. The upper contact with coarser clastics is gradational (Text-fig. 5.19), the shale representing the basal part of coarsening-upward rhythms. Fissility obscures sedimentary structures.

Facies C1b. Silty shale.

Silty shale occurs in two distinct settings in member C. These are distinguished here by separation into subfacies;

Subfacies C1bi. Planar laterally continuous intervals (Pl. 20, fig. 1; Pl. 21) overlying facies C1a; representing an intermediate lithology in coarsening-upward rhythms (Text-fig. 5.19). Silt-sized particles are disseminated throughout the shale matrix. This facies grades upwards either through the gradual increase of clean silt laminae to facies C2A, or more abruptly into facies C3. Planar lamination, cross lamination and bioturbation are common.

Subfacies C1bii. Channel fill. Broad channel scours (Pl. 18; Pl. 20, figs. 3, 4; Pl. 21) are either completely filled with shale plugs, or have a shale capping to a fining-upward sequence. This channel-fill shale is generally siltier than subfacies C1bi. Parallel channel-fill laminae, highlighted by intercalated parallel thin silt laminae, are characteristic (Pl. 20,


-2·5 Meters
Current laminated slightly calc. sandstone
Sharp contact
Silt/fine sandstone increase upward
Interlaminated silts and shales
Silty shale
Shale
A
Rippled and cross-laminated slightly calc. sandstone
Current-bedded bioclastic calc. sandstone
Sharp or gradational contact
Silty shale
Shale
B
Coral/Sponge biolithite
Current-bedded bioclastic calc. sandstone
Corals in distinct beds
Slightly rubbly bedded calc. sandstone
Gradational contact
Calc. siltstone
Interlaminated siltstone and shale
Shale
C

Text-figure 5.19: Variation in cleaning/coarsening-up rhythms in member C. See text for explanation.

fig. 3).

Lithotype 2: Interlaminated silty shale/siltstone.

This facies occurs in two modes;

Facies C2a; Planar layers in strike-continuous coarsening-upward rhythms (Pl. 20 fig. 1); and

Facies C2b; In local fining-upwards channel-fill sequences (Pl. 19 fig. 7).

Irrespective of the mode of occurrence, the interlaminae exhibit cross lamination, ripple forms, loading features and bioturbation.

Lithotype 3 -Sandstone

Silt content is variable and gradational from siltstone to sandstone. This spectrum is treated, for simplicity, as a single sandstone lithotype. Three facies occur;

Facies C3a. Slightly calcareous siltstone/sandstone.

Calcareous content is approximately 15-20%. This facies is distinct from facies C3b on account of a paucity of bioclasts, a cross bedded and flaggy weathering pattern and a characteristic light buff weathering and fresh colour. This facies occurs in two modes:

Subfacies C3ai; As a capping to strike-continuous coarsening-upward rhythms (Pl. 18; Pl. 20, fig. 1). Current bedding and cross lamination tend to be obscured by bioturbation.

Subfacies C3aii; channel-fill sequences (Pl. 20, figs. 4-7). Usually occurring near the base of the channel, but separated from the scour base by a rip-up clast or shell lag. In this setting the sandstone grades upwards into lithotype C2. In predominantly shale filled channels, calcareous sandstones can occur as isolated lenses and dune-forms (Pl. 20, figs. 4, 5, 7; Pl. 21) exhibiting asymptotic cross lamination, planar lamination, current lineation, interference rippling, loading features, slump features and bioturbation.

Facies C3b. Bioclastic calcareous siltstone/sandstone.

This facies is distinguished from facies C3a by a greater calcareous content (20-35%), an increase in bioclasts, a rust-brown weathering colour and a grey-green fresh colour. Bioclasts include brachiopods, corals, sponges, bivalves, nautiloids and crinoid ossicles. Facies C3b exhibits two modes of occurrence in member C:

Subfacies C3bi; Occurs in the upper part of strike-continuous coarsening-upward rhythms as planar massive weathering intervals. Bedding and cross lamination is evident in these intervals by distinct layering to in-life-position coral heads, and to current layering of brachiopod valves (Pl. 19, figs. 4, 5, 6).

Subfacies C3bii; Channel lag. This subfacies is confined to the scour base of large channels and hence is of limited lateral and vertical extent. This subfacies grades upwards (in centimeters) into subfacies 3aii.

Facies C3c. Rubbly bedded calcareous sandstone/siltstone (Pl. 19 fig. 3):

Similar in character to facies B4bi in member B. In contrast to the importance of rubbly bedded facies in member B, such facies are rare in member C. Facies C3c occurs in strike-continuous coarsening-upward rhythms either at the base of, or in, intervals of subfacies C3bi (calcareous bioclastic sandstone). This facies is variably bioclastic with coral and brachiopod hash. Dark grey weathering bioclastic calcareous siltstone 'lumps' usually arranged along vague bedding make up 40-60% of the facies. The matrix consists of rust-brown weathering bioclastic calcareous sandstone similar to that of facies C3b.

Lithotype 4 -Limestone (Coral/Sponge Biolithite).

Biostromes form at the top of the more calcareous coarsening-upward rhythms through an increase in corals and sponges in subfacies C3bii. Most of the corals are in life position. The matrix (10-30% by volume) consists of calcareous silty sandstone, locally containing crinoid ossicles. Biolithite 'biostromes' occur ten to twenty meters stratigraphically above the member B/C boundary in outcrops between Blubber Point (section 81G) and Muskox Fiord (Section 82B Spot Samples; Pl. 19, figs. 1, 2). Biostromes of this type are absent at this level in the Baad Fiord section (section 83A). At this locality thin biostromes occur stratigraphically higher near the member C/D boundary.

Interrelationship between facies

Like members A and B, much of member C is characterized by repetitive coarsening/cleaning up rhythms approximately three meters thick (Text-fig. 5.19). These rhythms are shale based, becoming sandier up rhythm. The contact between the sandy top of the preceeding rhythm and the shale base of the next rhythm is invariably sharp, and usually planar.

A threefold variation in style of the coarsening-up rhythms is present (Text-fig. 5.19a, b and c), Common to all three types is a gradational coarsening-up from the shale base to silty shale and siltstone. Above this, however, variation occurs. The rhythms depicted in Text-fig. 5.19a and 5.19b vary in bioclastic content, but are similar in that both show a gradational coarsening-up sequence sharply overlain by massive or current laminated calcareous sandstones. The rhythm in Text-fig. 5.19c differs in being more calcareous, possessing some slight rubbly bedding, and in the development of coral/sponge biostromes. These biostromes are especially well developed at the base of member C in the Goose Fiord and Muskox Fiord areas of southwest Ellesmere Island. There is no apparent correlation of rhythm type with stratigraphic position in member C.

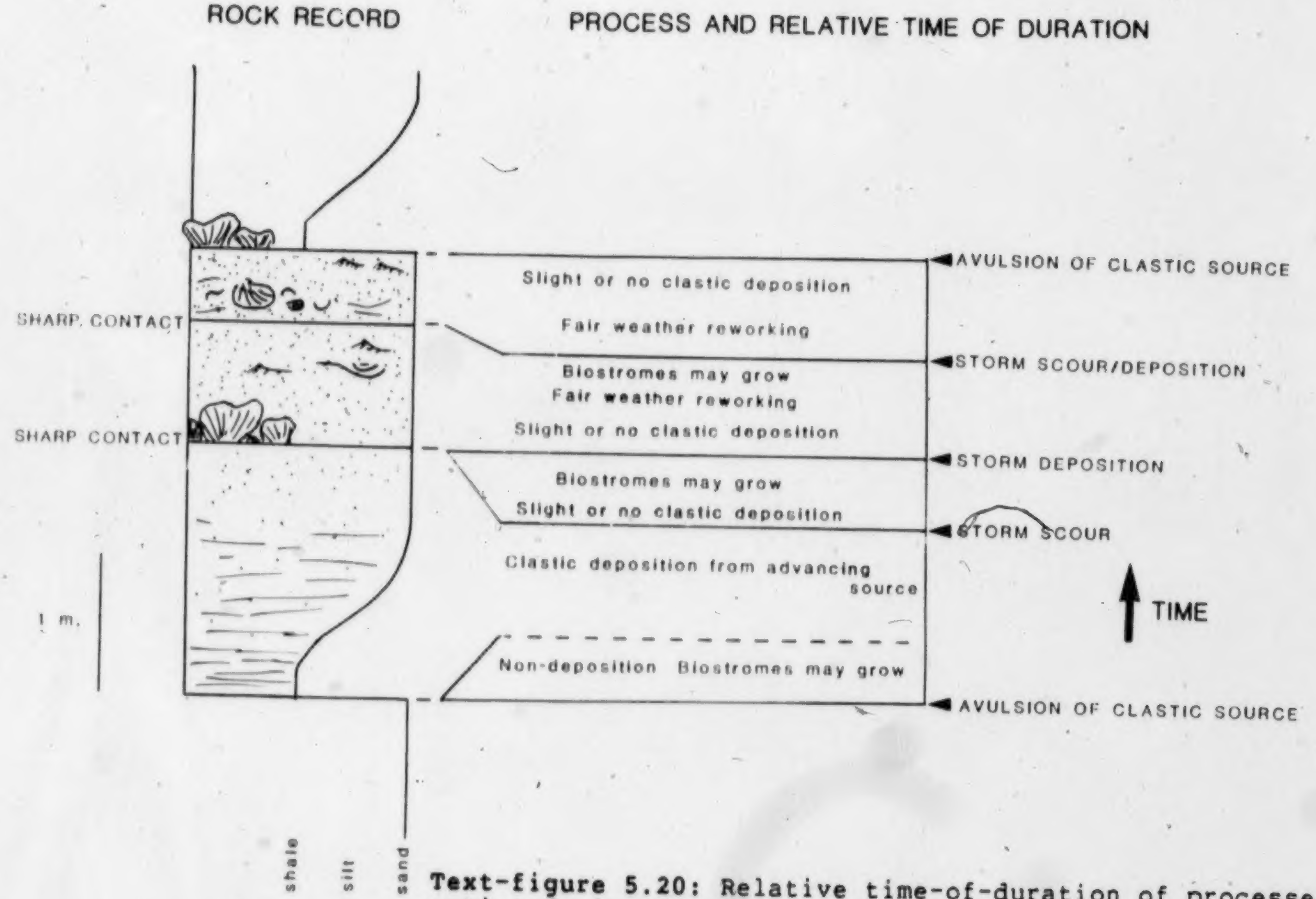
In much of section 83A (the reference section for member C), small scale vertical facies variation is complimented by strike homogeneity, the beds in the rhythms having a sheet-like geometry. However, several distinct intervals exhibit strike facies variation due to the presence of large scale channeling and of low amplitude large wavelength bar forms (Pls. 18, 21 -in rear fold).

Some of the channels are filled with laminated argillaceous siltstone plugs (Pl. 20, fig. 3; Pl. 21, fig. A). Others show well defined fining-upward fill sequences grading from a thin bioclastic or shale rip-up conglomerate lag at the base to current lineated slightly calcareous sandstones. These in turn grade into rippled and bioturbated interlaminated silty shales and siltstones to a silty shale cap. Bars (or sandwaves) composed of calcareous sandstone, of low relief (1.5-2.5 meters) and considerable horizontal extent (in excess of 50 meters) are preserved at two levels in section 83A (Pl. 21, figs. A and B).

Interpretation

Member C differs from members A and B in being predominantly composed of clastic rocks. Discussion of sedimentation type and process for this member must consider sources for the clastic material. The presence, type, and abundance of marine faunas throughout member C indicates deposition in a shallow shelf setting.

The small scale coarsening-up rhythms (1-3 meters thick) characteristic of member C result from variation in clastic input from a nearby source, and redistribution of the clastic material on the shelf (Text-fig. 5.20). It is difficult to interpret rhythm formation as resulting from migration of shallow marine bars owing to the general


ROCK RECORD
PROCESS AND RELATIVE TIME OF DURATION
SHARP CONTACT
SHARP CONTACT
1 m.
shale
silt
sand
Slight or no clastic deposition
Fair weather reworking
Biostromes may grow
Fair weather reworking
Slight or no clastic deposition
Biostromes may grow
Slight or no clastic deposition
Clastic deposition from advancing source
Non-deposition Biostromes may grow
AVULSION OF CLASTIC SOURCE
STORM SCOUR/DEPOSITION
STORM DEPOSITION
STORM SCOUR
TIME
AVULSION OF CLASTIC SOURCE

Text-figure 5.20: Relative time-of-duration of processes active during deposition of cleaning/coarsening-up rhythm, member C. See text for explanation.

absence of trough cross stratification, and to the sheet-like geometry of the beds. Small scale bars were recognised within rhythms (Pl. 20, fig. 2), but are not normally present. The basal, gradational part of the rhythms (from shale to argillaceous siltstone to silty sandstone) may have resulted from shoaling due to bar migration. This part of the rhythm appears to reflect the advance of a nearby clastic source. The upper sandstone sheets commonly possess sharp basal contacts and show little evidence of lateral accretion. They are either massive or current bedded. Sedimentary structures are poorly preserved due to the homogeneity of the sedimentary particles; cross lamination is visible locally only due to the presence of a bioclastic lining. Coral biostromes are present on the sharp bases (Pl. 19 fig. 4). The corals are both in life position and are overturned.

The sharp basal contacts of the sandstone beds, which are generally planar, are apparently erosive. The growth of coral biostromes on these planes suggests periods of non-deposition followed by pulses of sedimentation of calcareous, variably bioclastic, sandstones which entomb the biostromes. These pulses of sedimentation resulted from storms. Variation in storm strength was recorded by either preservation of the coral biostrome in life position, or by its disruption. Storms acted both as agents of erosion and deposition (Text-fig. 5.20). Storm pulses represent a small amount of the time taken for the deposition of a rhythm.

They were responsible, however,for most if not all of the deposition in the rock record. Much of the time represented by each rhythm was taken up by non-deposition or minimal deposition. During these time periods biostromes might grow; the major processes (wave action, shelf currents -Porter, 1976) resulted in reworking of the 'instantaneous' storm deposits.

Cotter (1975) attributed thin, planar and ripple laminated sandstones interbedded within a broadly upward coarsening sequence of bioturbated silty sandstones (the late Cretaceous Washboard unit of the Ferron Sandstone) to storm activity in a quiet nearshore setting. Cotter (1975, p. 678) envisaged the environment of deposition of the Washboard unit as being

> 'close enough to shore to receive occasional rapid influxes of sand, possibly during storms'.

Hayes (1967) documented the redistribution of sediment from the shoreline to the adjacent shelf during hurricanes. Reineck and Singh (1980) attributed thin sand layers in Dutch offshore silts and muds to offshore sediment movement by storms.

Two mechanisms of movement of sand from the shoreline onto the shelf have been proposed. Hayes (1967) proposed seaward directed storm surge ebb bottom flows as the major mechanism. This idea has recently been questioned by Swift *et al* (*in* Walker, 1984) who contended that the storm surge ebb is insignificant in comparison to geostrophic flow parallel to the shelf isobaths. Walker (1984) favoured liquefaction of shoreline sands by cyclic wave loading, the liquified sediment flowing seaward across the shelf as a turbidity current. Deposition from this flow below storm wave base would be in the form of Bouma sequences. Above storm wave base, interaction of storm waves and geostrophic currents would rework the turbidity currents into hummocky cross stratified sandstones. Above fairweather wave base, hummocky cross stratification would be reworked by fairweather processes and the characteristic storm induced bedform would be destroyed.

The sandstone beds in member C are interpreted as such storm deposits, laid down in a nearshore setting above fairweather wave base. The sheetlike geometry of the sandstones is due to a combination of storm sheet deposition and intense fairweather (wind and wave action) reworking.

The three rhythm types cartooned in Text-fig. 5.19 probably reflect differences in clastic sedimentation rate (influenced by proximity of the clastic source) in a 'limestone prone' area (a warm water area in which sufficient calcium carbonate fixing occurs so that limestones may be produced). Those rhythms possessing abundant coral and sponge faunas likely formed in fully marine conditions relatively distant from the fresh water and muddying influence of a clastic source (nearby deltas). According to Leão (1982), corals at present are sensitive to fresh water influxes, but are relatively insensitive to the presence of clastic sedimentation. Their presence or absence in member C rhythms may reflect variable salinities and substrate stability. The unfossiliferous rhythms (Text-fig. 5.19a) may represent shelf redistribution and deposition proximal to the clastic source(s).

Cant (1984) recognised what he termed 'minor units or sequences' in larger coarsening-upward sequences in the Cretaceous Spirit River Formation of west-central Alberta (interpreted as a shoreline to shallow shelf deposit). Cant (1984, p. 553) speculated

> 'The origin of these minor sequences can probably be related to variations in coarse sediment supply. These fluctuations could result from shifting of distributaries, the local sediment input point, ... or minor climatic fluctuations.'

Information from the Bird Fiord Formation prompts agreement with Cant (1984) on the above points and also with Cant's (1984, p. 553) deduction that the small-scale rhythms were not related to sea-level fluctuation. If this were so the number of rhythms in member C would suggest an inordinate flux in sea-level which could only be explained by active tectonism - or glacial advances and retreats (Whittington, pers. comm., 1984). It is easier to explain the rhythms in member C as resulting from variation in local sediment supply due to avulsion of distributaries (see Chapter IX).

The broad channels in member C (Pls. 18 and 21) may be of tidal channel or delta-margin distributary channel origin. The overall dominance of planar bedding in member C, and lack of large scale cross stratification, as would be expected if tidal currents were of importance (Johnson *in*

Reading, 1978), suggests a distributary current origin. The 17-25 meter interval in section 83A (Text-fig. 5.18; Pl. 21A) probably represents channeled distal mouthbar deposits intercalated with shelf-process dominated coarsening-upward sequences (see overlay for Pl. 18).

The very large scale, low relief, low angle, cross-bedded barforms (Pl. 21 fig. B) are demonstrably of marine origin owing to their bioclastic content and intimate association with other marine facies. The low amplitude and simple cross stratification (Pl. 20, fig. 5; Pl. 21, figs. A, B) differ from examples of sandwaves in which thicknesses >10 meters of lensoid sandstone bodies containing multiple cross-sets have been reported (Nio, 1976; Nio and Siegenthaler, 1978; Duke, 1972; Blakey, 1984) The low amplitude sandwaves, or bars, in member C resemble the 'initial sandwave facies' of Nio (1976).

Member C Summary

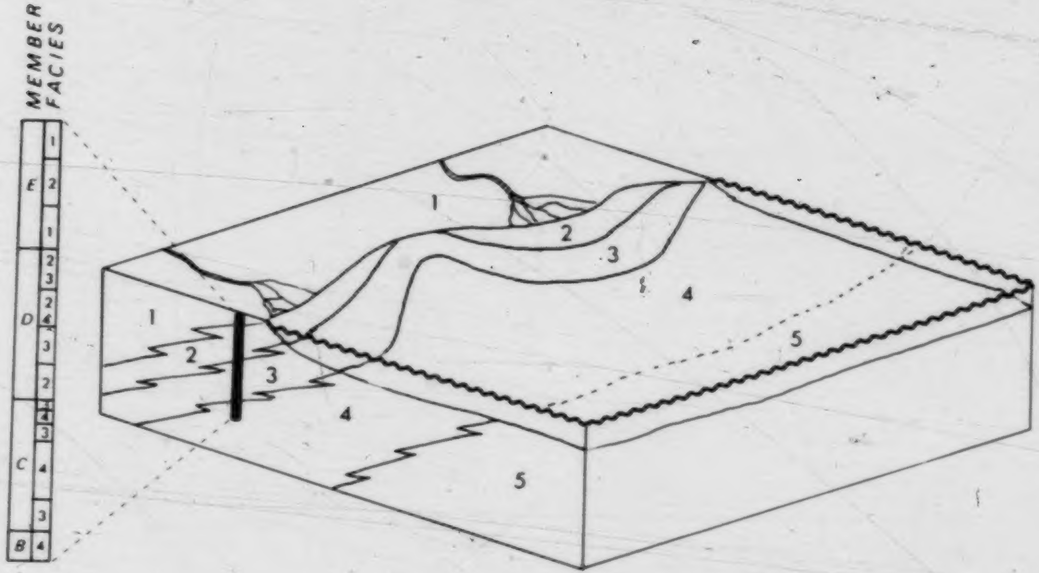
Two scales of variation in sediment input, indicated by different styles of sedimentation, are inferred in member C (see Pl. 18); these are namely;

1. Minor fluctuations in sediment input from a relatively distal source as evidenced by intervals of 'open shelf' small scale coarsening-up rhythms (Text-figs. 5.19, 5.20), and

2. The proximity of a clastic source as evidenced by more argillaceous silty intervals with complex bedforms (large

scale channeling, low amplitude large wavelength bars/sandwaves -Pl. 21). A distal delta-margin position is suggested for these intervals (Text-fig. 5.21). Large scale channeling and associated channel lag sandstone lenses and fining-up channel fills (Pl. 21, fig. A) represent concentrated flows from nearby distributary channels.

Member C was deposited largely in an open shelf environment. This is indicated by the presence of marine faunas throughout the member. The sheetlike, repetitive, coarsening-up rhythm style of sedimentation and the abrupt changes in sedimentary style in the member point to efficient distribution of sediment. The absence of large scale sandwaves may have resulted from the generally regressive situation: Nio (1976) and Dike (1972) attributed sandwaves to **transgressive** reworking of sands. Alternatively this absence of sandwaves may have resulted from a lack of significant tidal currents. Evidence for the rapid deposition of the sandstones, their sheetlike distribution (Pl. 18; Pl. 25, figs. 1-8) and sedimentary structures indicate a dominance of storm processes. The storm deposits underwent fairweather wave-dominated reworking (based on the lack of significant tidal current features -see Johnson *in* Reading, 1978). The lack of fining-upward sequences within the sheet sandstones indicates either a very sorted sand source for the sheets, or destruction of such a grading after storm deposition by fairweather processes. It is apparent that only when the clastic source was immediate


MEMBER
FACIES
E
D
C
B
1
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3
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4
5

Text-figure 5.21: Positions of members B, C, D and E with relation to facies belts associated with delta advance over a shallow shelf setting. Column to right shows schematic stratigraphic distribution of facies belts within Bird Fiord Formation members on southwest Ellesmere Island. 1) Delta plain 2)Delta margin shoreline accretional sand 3) Distal delta margin/nearshore shelf. 4) Proximal and distal shelf 5) Marine slope.

were the effects of the shelf redistribution processes overshadowed by the processes of deltaic sedimentation. Delta avulsion probably accounts for the abrupt changes in style of sedimentation in member C (Plate 18).

E. MEMBER D

Introduction

Member D is approximately 175 meters thick in the Goose Fiord area. The member weathers semi-recessive at the base, but becomes more prominent upwards with an increase in sandstone over argillaceous lithologies. Accessible exposure is hard to find as the lowermost argillaceous portion tends to be obscured by sandstone scree. The upper portion of the member commonly outcrops as felsenmeer. Member D may be a partial lateral equivalent to member E in the easternmost portion of the reference area (Text-fig. 5.1).

The lowest sixty meters of member D were measured in detail in sections 82C and 83A. A reconnaissance measurement through most of the member was made at section 81G where outcrop was good but inaccessible for close scrutiny. The uppermost 43 meters of section 83A was chosen as a reference section for member D (Text-fig. 5.18) due to its' accessibility and proximity to the reference section for member C. The member is transitional between the repetitive coarsening-upward rhythms of member C and the sandstone-dominated, fining-upward sequences of member E.

The base of Member D is picked at the first ≈10 meters thick light grey/buff weathering non-calcareous sandstone horizon. The color contrast between these light colored, non-calcareous sandstones and the darker-weathering, calcareous sandstones of member C facilitates recognition of this boundary (Pls. 18, 22).

Facies description

Shale, siltstone and sandstone are the three endmember lithotypes present in member D.

Lithotype 1 -Shale

The recessive and cleaved nature of the outcrops prohibit detailed examination. Basal contacts are, where exposed, sharp. Upper contacts are usually gradational. Shale, variably silty in content, occurs in two modes:

Facies D1a/. At the base of coarsening-upward rhythms - as seen in members A, B and C.

Facies D1b/. At the top of fining-upward channel-fill sequences.

Lithotype 2 -Siltstone

Pure siltstone is rare in member D. This lithotype commonly occurs in lithological gradation between shales and sandstones (and vice-versa). Two subfacies are recognised;

Facies D2a. Argillaceous siltstones. Associated with coarsening upward sequences and fining upward sequences (Pl. 23, fig. 4). Occurs as an argillaceous silt/silty shale wavy-laminated matrix with interlaminated pure siltstone/fine sandstone flasers and discontinuous planar laminae. Bioturbation is common and can have destroyed all primary sedimentary structures. Slight cleaning of the argillaceous silt matrix can occur at the bases of small scale scours (approximately 3 meters broad, 30 centimeters deep) and may be associated with small cross-bedded fine sandstone bar forms (as in member C: Pl. 20, fig. 2).

Facies D2b. Argillaceous siltstones interstratified with non-calcareous sandstones (Pl. 24, figs. 1, 2). The upper and lower boundaries are sharp and are locally erosive. Intervals of this subfacies consist of variably pure siltstones interlaminated with silty shales. Cross-lamination, minor scouring and bioturbation are common.

Lithotype 3 -Sandstones

Two distinct facies of sandstones are present; each facies occurs in a distinctive mode.

Facies D3a. Bioclastic calcareous sandstone: Calcareous sandstones are readily distinguishable in the field from facies D3b (non-calcareous sandstones) by their rusty yellow to rusty red weathering colour, and their greenish-grey fresh colour. They occur in three modes in member D, each mode having unique lithological characteristics:

Subfacies D3ai; Bioclastic calcareous sandstones occur at the top of coarsening-upward rhythms (Pl. 23, fig.

4). Bioclastic content usually includes brachiopods (articulated and disarticulated) and corals: the latter are commonly in life-position along planar bedding (as in facies C4). Current bedding (indistinct cross-lamination, minor scours, current-sorted shell layers) is ubiquitous. Outcrops usually weather massive, but locally exhibit blocky and flaggy weathering along current laminae. Curious cementation fabrics (Pl. 23, fig. 3), presumably resulting from local porosity differences within the cross laminated and cross bedded sandstones, can also occur. The bases of intervals of subfacies D3ai can be sharp or gradational; their tops are usually sharp.

Subfacies D3aii; Sparsely bioclastic calcareous sandstone layers (approximately 1 meter thick) occur in or on top of facies D3b (non-calcareous sandstone). Bioclasts are less numerous in this subfacies than in subfacies D3ai. Corals are rare or absent; disarticulated brachiopod valves occur most frequently. These intervals are current bedded, commonly weathering massive.

Subfacies D3aiii; Coquinoid calcareous sandstone occurring as thin (30-50 centimeter thick), laterally discontinuous scour lags (Pl. 24, fig. 7). This subfacies commonly occurs in scours at the base of thick intervals of facies D3bii. Most of the bioclasts are disarticulated brachiopod shells which can form up to

50% of the rock. Rare bivalves and occasional fish bones are also present.

Facies D3b. Non-calcareous sandstones:

These sandstones are easily recognisable in the field due to their very light grey to buff weathering. Shelly fossils are either totally absent, or very rare whereas plant remains are locally common. This facies occurs in three modes:

Subfacies D3bi; Non-calcareous sandstone in thin, cross-laminated beds (30-50 centimeters thick) and laterally discontinuous planar beds in silty shales. Planar lamination in these thin beds is common. Linear symmetrical rippling is common in some beds, but is commonly obscured by pervasive bioturbation. Small bar-forms can be preserved. These are usually associated with thin fining-upwards sequences occurring in larger coarsening-upward rhythms (Pl. 23, fig. 4); they apparently represent scour-base sediment in ephemeral channels.

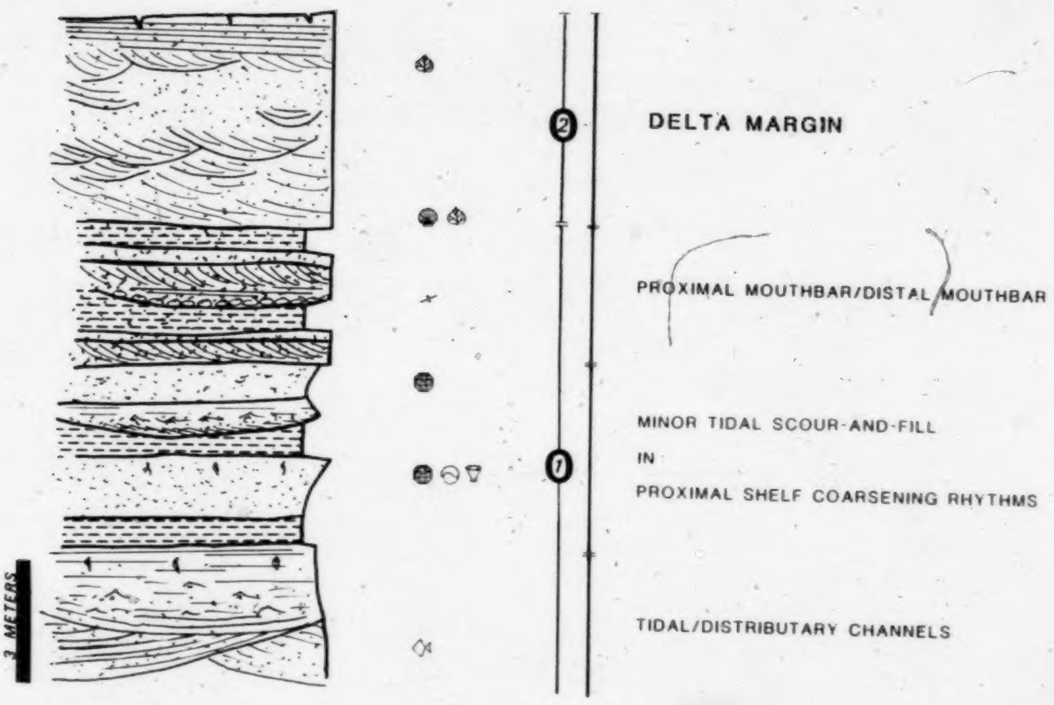
Subfacies D3bii; Non-calcareous sandstone in 1-10 meter thick intervals showing pervasive unidirectional cross-bedding (sets 10 cms to 1.5 meters thick), planar lamination, current lineation and rippling (Pl. 22; Pl. 23, fig. 2). Small channels (approximately 6 meters wide by 1 meter deep), lagged with subfacies D3aiii, are common near the bases of the thicker intervals of this subfacies. Slumping and loading features (Pl. 24, figs.

3, 5 and 6) are common. These units have sharp erosive bases and generally sharp tops with either facies D2b or subfacies D3aii. They are laterally extensive, but can be seen to pinch out in cliff sections (Pl. 26, fig. 7).
Subfacies D3biii. Non-calcareous sandstone occurring as fill to large channels (10-30 meters wide by 2 to 4 meters deep). These channel plugs are massive. No grading is present. Laminae parallel the base of the channel (Pl. 23, figs. 1, 5).

Interrelationship between facies

Member D facies occur in two distinct sedimentary styles; 1) 3-5 meter thick shale → siltstone → calcareous sandstone coarsening-up rhythms, intercalated with 2) thick (greater than 10 meters) non-calcareous sandstone-dominated intervals (Text-fig. 5.22).

The repetitive coarsening-up rhythms are similar to those described from member C. A difference lies in the common interruption to the regularity of these rhythms by smaller scour and fill fining-up sequences (Text-fig. 5.21; Pl. 23 fig. 4) rhythms in member D. Member D rhythms commonly have a greater argillaceous content than member C rhythms and generally show gradational internal boundaries between facies. Variably rich coral and brachiopod faunas, with a rare crinoid ossicle and sponge content similar to those in member C, are present.


②
DELTA MARGIN
PROXIMAL MOUTHBAR/DISTAL MOUTHBAR
MINOR TIDAL SCOUR-AND-FILL
IN
PROXIMAL SHELF COARSENING RHYTHMS
①
TIDAL/DISTRIBUTARY CHANNELS
3 METERS

Text-figure 5.22: Cartoon of typical sequence in member D. Environmental interpretation to right. See text for discussion. 1. Background of shale-siltstone-calcareous sandstone coarsening up rhythms which contain modification due to tidal action (bar migration, channeling). Proximal and deltaic shelf. 2. Thick non-calcareous sandstone horizons. Delta margin, accretion sandstone.

The thick non-calcareous sandstone intervals usually have sharp, locally demonstrably erosive, bases and show evidence of channeling, these channels being lined with discontinuous lags of shale rip-up clasts and shell debris. Slump and loading features are common. Above the immediate base the sandstones characteristically have large scale (nearly always unidirectional (Pl. 22; Pl. 23, fig. 2; Pl. 24 fig. 4) cross-stratification and current lineation. Small scale channeling is common in the upper portion of the thicker, more massive sandstone units where it accompanies trough cross-stratification, planar bedding and low angle planar cross-stratification (Pl. 26, figs. 4, 8). Fossils are either absent, or are dominated by plant remains with rare bivalves.

Non-calcareous, sandstone-dominated bluffs in member D locally show alternation of recessive argillaceous siltstones and cross stratified sandstones (Pl. 24, figs. 1, 2; Text-fig. 5.22). Contacts between the lithologies are abrupt, and in many cases, obviously erosive. In many cases a thin layer of current bedded or massive calcareous sandstone (50 centimeters to 1.0 meters thick) caps the non-calcareous sandstone unit.

Complex interstratification of planar bedded and cross-stratified, channeled, non-calcareous sandstones with bioclastic calcareous siltstones and silty shales are present at some localities (Pl. 23, fig. 6).

Interpretation

The bioclastic, small scale, coarsening-up rhythms probably formed as a result of processes similar to those outlined for the 3-5 meter thick rhythms described for member C. Minor channeling, common in the member D rhythms, attests to concentration of shallow shelf currents - possibly of tidal origin. The higher argillaceous content of the member D rhythms, and their generally more gradational facies transitions, may be due to lesser effectiveness of storm and fairweather winnowing in the member D rhythms than for the member C rhythms. This might have resulted from sedimentation in semi-protected embayments sheltered from storm effects, proximal to deltaic clastic sources.

High energy of deposition is indicated by the thick non-calcareous sandstones which have sharp erosive bases, channeling at the base of the intervals, ubiquitous cross stratification, and common current lineation. Slumping and dewatering features attest to rapid deposition. Complexity of structures increases with thickness of the sandstone. The thin sandstones (less than 10 meters thick) possess unidirectional cross stratification. These are interpreted as proximal mouth bars from delta distributary channels. These sandstones are commonly interbedded with argillaceous siltstones of distal mouth bar origin (Pl. 24, figs. 1, 2). Commonly the proximal mouth bar sandstones rest directly on shelf coarsening-up rhythms without the expected intervening distal mouth bar deposits (Horn Saxena and Ferm, 1981 fig.

42). It appears that a combination of erosion by distributary scouring prior to proximal mouth bar deposition, and redistribution of the distal mouth bar deposits by active shelf processes, resulted in the loss of the fines.

The thicker, non-calcareous sandstones display a wide array of sedimentary structures, including: low angle planar cross stratification, trough cross stratification, planar bedding and lamination, current lineation, and variable scales of channeling. They are attributed to delta margin accretion; the spectrum of sedimentary structures probably represents intermittently exposed beach and near-shore environments in a delta margin.

Successive cliff photographs along dip in cliffs on the east coast of North Kent Island (Pl. 25, figs. 1-8; Pl. 26, figs. 1, 2) show interdigitation of dark-weathering, calcareous sandstones and siltstones with non-calcareous light coloured sandstones, the latter pinching out into the former in a northward trend. A similar transition can be seen on the west coast of North Kent Island (Pl. 26, fig. 7). Sheetlike, sandstones pinching out northward probably represent delta margin sands, abandoned distributary lobes, and proximal distributary mouthbars, variably reworked by shelf processes. An analogous reworking of abandoned delta lobes by shelf processes is presently occurring in the abandoned eastern lobes of the Mississippi delta (Saxena and Ferm, 1976; Horn, Saxena and Ferm, 1981; Coleman and Prior,

1980) and the Rhône delta (van Straaten, 1960 *in* Elliott, 1978). Shelf reworking of the abandoned lobe destroys the 'deltaic' aspect of the lobe, leaving it to be preserved as extensive sheetlike sands (Horn, Saxena and Ferm, 1981).

Member D Summary

Member D records the advance of deltaic influence onto a shallow shelf (Text-fig. 5.21). The basal portion of member D (1. in Text-fig. 5.22) represents a shelf-process dominated setting in which distal delta deposits were redistributed by active shelf processes (storm and wave action). This is indicated by the absence of the 'typical' delta profile of prodelta clays grading up into deltaic sands (Scruton, 1960; Horn, Saxena and Ferm, 1981). It appears that the shelf redistribution processes were able to redistribute proximal mouthbar sands close to a distributary depocenter (2. in Text-fig. 5.22). Distal mouthbar deposits were preserved only when the delta influence was sufficiently strong to overshadow shelf processes. In this situation, fine grained distal mouthbars are intimately associated with proximal mouthbars (Pl. 24, figs. 1, 2). Short term increases in marine influence, probably due to distributary shifting, are indicated by the occurrence of modified bioclastic coarsening/cleaning up rhythms between the non-calcareous sandstone mouthbar deposits (Pl. 23, fig. 4) and by the reworking of the tops of the proximal mouth bars (Pl. 24, figs. 1, 2). Concentrated flows, probably initiated by distributary channels and reinforced by tidal currents, are evidenced by calcareous sandstone channel-fill sequences (Pl. 23, figs. 1, 4, 5 and 6).

F. MEMBER E

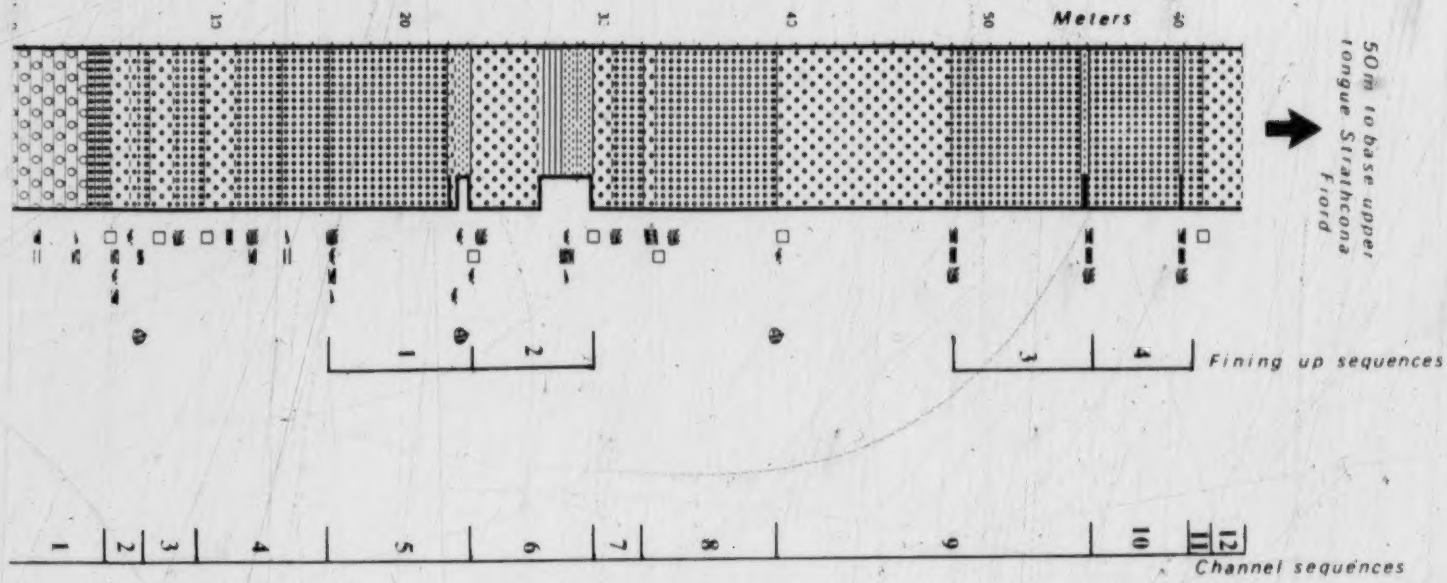
Introduction

The contact of member D with member E is considered to be gradational. This contact was not observed and hence its position is unknown.

Poor exposure makes it difficult to determine the lateral extent of member E. A partial section of the member (section 83GRF2) was measured in the easternmost part of the reference area (area D in Text-fig. 4.1; see Text-fig. 5.1 for location of section) where the member is in excess of 100 meters thick. This is designated the reference section (Text-fig. 5.23). Extension of member E farther west is tentative (Text-fig. 5.1). Very brief examination of sandstones at the top of the Bird Fiord Formation on the east coast of North Kent Island (section 81H) suggests that member E is not present at this locality.

Facies description

Member E is composed entirely of clastic sedimentary rocks. Three end-member lithotypes are present- Shale, Siltstone and Sandstone. Detailed examination of section 83GRF2 has shown the presence of six distinct facies:


Meters
0
10
20
30
40
50
60
50m to base upper tongue Strathcona Fiord
Fining up sequences
1
2
3
4
Channel sequences
1
2
3
4
5
6
7
8
9
10
11
12

Text-figure 5.23: Reference section member E (section 83GRF2, Grise Fiord). Fining-up rhythms to next-right of column. Individual channel events indicated at far right. Symbol explanation in appendix.

Lithotype 1 -Shale

Pure shale is not present. Predominantly argillaceous lithologies always have a noticeable silt content (interlaminated with, or dispersed in, an argillaceous matrix). Silty shales (facies E1a) are always of limited lateral extent (Pl. 27, fig. 3; Pl. 28, fig. 2). One outcrop of this facies in section 83GRF2 contains abundant plant fossils and has a distinct black color and coal-like texture.

Lithotype 2 -Siltstone

There is continuous gradation between silty shale (facies E1) and sandstone lithologies through increasing interlaminae of siltstone and sandstone in an argillaceous matrix. Silt and sand sized particles are commonly interlaminated and negate the division of pure siltstone and sandstone facies. Non argillaceous lithologies, whether they contain both silt and sand sized particles or only sand sized particles, are referred to the sandstone facies. A single 'siltstone' facies is distinguished.

Facies E2a. Silty shale interlaminae with siltstone/fine sandstone (Pl. 28, fig. 3). Argillaceous laminae generally increase in abundance and thickness upwards so that units of this facies grade upwards into silty shale (facies E1). Interlaminae show rippling and irregular wavieness- the latter locally associated with loading structures (Pl. 28 fig. 3). Lateral discontinuity of facies E2a is explained by its occurrence as fill to channel scours. Planar layers of this facies also pinch out laterally due to erosion by succeeding channel events. Plant fossils are locally present.

Lithotype 3 -Sandstone

Four types of sandstone, or sandstone based, facies are present:

Facies E3a. Wavy laminated sandstone/coarse siltstone This facies always underlies, and grades upwards into, facies E2a. It consists of successive wavy and rippled laminae of coarse siltstone and fine sandstone.

Facies E3b. Thinly flagged/cross bedded sandstone. This facies is the most common in section 83GRF2. It consists of planar flagged and asymptotically cross bedded fine sandstone. Scour surfaces and minor scour fill are present, but asymptotic (possibly some epsilon) cross stratification is by far the dominant bedform (Pl. 27, figs. 1, 2, 4; Pl. 28, figs. 2, 4). Megaripples are locally preserved at the base of this facies (Pl. 27, fig. 1). Much of section 83GRF2 consists of oscillation between massive sandstone and this facies (Pl. 27, figs. 1, 2, 3).

Facies E3c. Massive sandstone (Pl. 27, figs. 1, 2 and 3). Featureless, massive sandstones 0.4 to 2.5 meters thick commonly overlie scour surfaces. Locally rip-up conglomerates (facies E3d) separate the massive sandstone intervals from the scour surface. Contacts between facies E3D and E3C are abrupt. The upper contact, most commonly with facies E3b, is abrupt.

Facies E3d. Rip-up conglomerates (Pl. 28, fig. 1). This facies is included under the sandstone lithotype due to the high sandstone matrix in all examples seen. Variably graded and imbricated shale rip-up conglomerates locally occur at the base of channel scours. Clasts are apparently of local origin, their lithology being identical to silty shale lithologies (facies E1a) preserved in pod-shaped erosional remnants (Pl. 28 fig. 2). The bases of rip-up conglomerates are sharp, arcuate and erosional. These intervals grade upwards into either massive or cross bedded sandstones.

Interrelation between facies

The single section of member E measured is dominated by interbedded, massive and cross-bedded sandstones. Scoured contacts at the bases of the massive sandstone beds, and the lensoid geometry of the beds, indicates that these facies represent repeated cut-and-fill. Rip-up conglomerates are present at the scour bases of many channels. Several, variably complete, fining-upward sequences of massive sandstone → cross bedded sandstone → current laminated siltstone → current laminated and loaded silty shale are present (Text-fig. 5.23).

Member E Interpretation and Summary

Repetitive channeling is attributed to channel migration; the succeeding channels eroding the upper part of the preceding channel fill sequence (Text-fig. 5.23). The lack of invertebrate fossils and bioturbation, coupled with the predominance of plant fossils and the locally coal-like nature of the silty shales, indicates a freshwater environment. Comparison of member E with the 'ideal' meandering stream fining-upward sequence, and the proposed braided stream sequence (Walker and Cant, 1979, 1984) shows that member E has a greater affinity to the braided stream eaxmple. Member E represents delta plain deposition.

VI. STRATIGRAPHY AND SEDIMENTOLOGY OF THE BIRD FIORD FORMATION OUTSIDE THE REFERENCE AREA

A. BIRD FIORD TO BAUMANN FIORD

Introduction

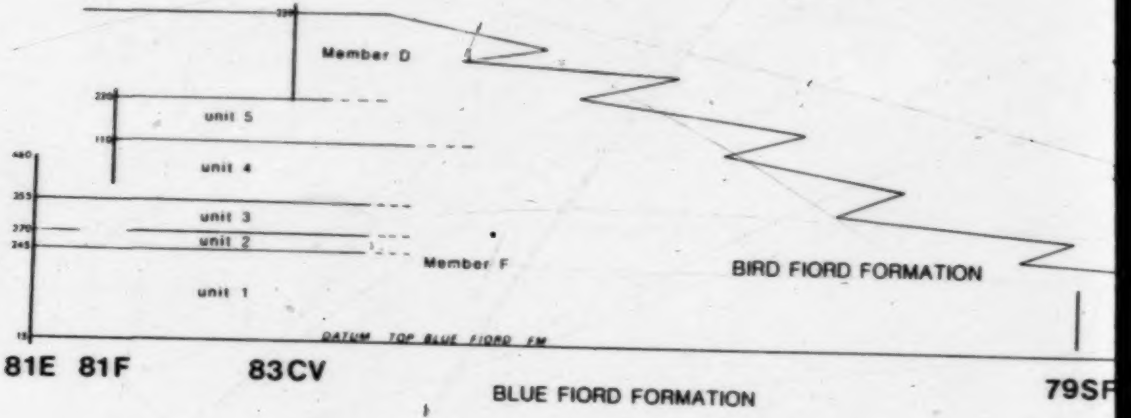
McLaren (1963) defined the type area of the Bird Fiord Formation as the environs of Bird Fiord, Ellesmere Island. He did not designate a type section. Kerr and Thorsteinsson (1972, Map 1312A) designated a type section for the formation in a stream cut 9 kilometers east of the head of Bird Fiord. This type section was not described since no memoir was published to accompany the map. Better exposures (sections 81E and 81F of this thesis) are now known to exist to the west of the type section. McLaren's work was of a reconnaissance nature. The present study has shown the inappropriateness of the Bird Fiord area for the type area of the Bird Fiord Formation because of the considerable stratigraphic variation within the formation.

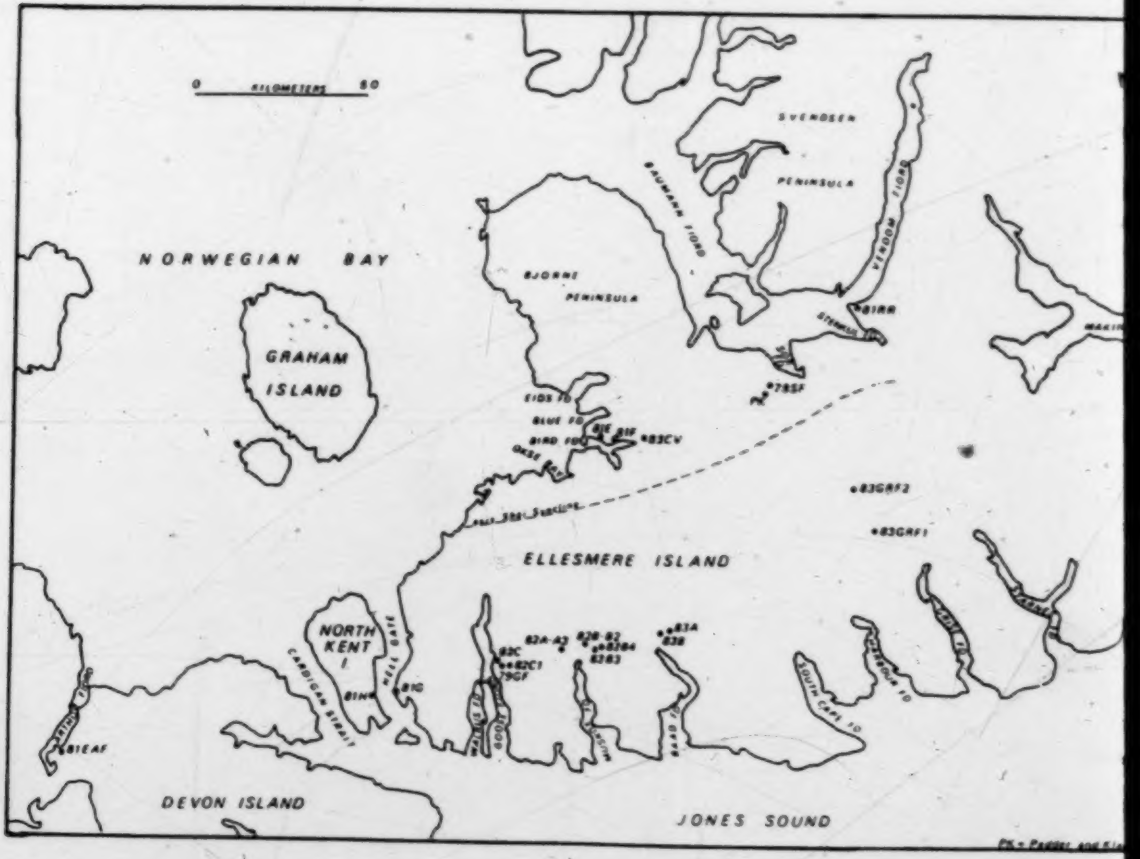
Significant facies and thickness changes occur across the axis of Schei syncline. In the environs of Bird Fiord, the Bird Fiord Formation is approximately 800 meters thick: it decreases to 550 meters in the Goose Fiord area. The four members discernible in the vicinity of Goose Fiord are not recognized north of the axis of Schei syncline. The lower 450 meters of the Bird Fiord Formation at Bird Fiord (assigned to member F; Text-figure 6.1) consist of intercalations of facies and facies successions seen within members A, B and C of area D (Text-fig. 4.1). Gypsites characteristic of Member A unit 1 and red siltstones and shales characteristic of Member A unit 2 are absent.

Lithostratigraphic correlation across the Schei syncline is possible only in the upper one third of the formation. Facies within these beds are correlatable to those present in Member D in southwest Ellesmere. Facies successions characteristic of Member E were not recorded; poor outcrop in this upper portion of the formation may mask their presence.

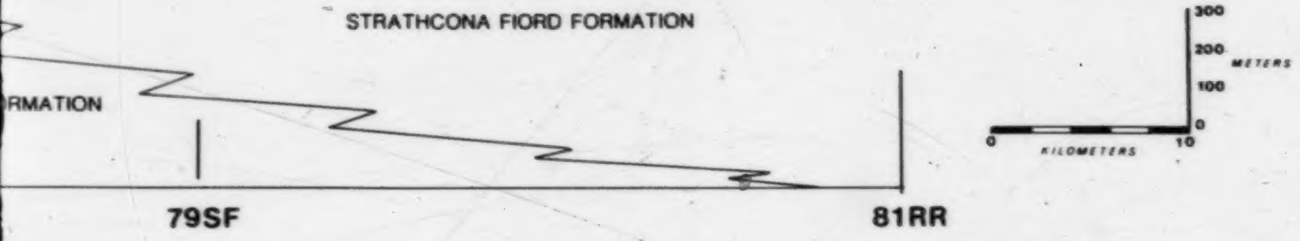
The lower 460 meters of the Bird Fiord Formation is reasonably well exposed in steep slopes on the north side of the mouth of Bird Fiord, approximately 5 kilometers east of Bird Island (section 81E; Text-fig. 6.1). A contiguous section (section 81F) is patchily exposed near a stream cut on the north side of Bird Fiord. The upper one third of the formation is not exposed, the sandstones of this interval weathering as blocky felsenmeer. The uppermost 150 meters (approximately) of the formation, and its contact with the crossbedded red siltstones and fine sandstones of the Strathcona Fiord Formation, is partly exposed at the top of the type section east of the head of Bird Fiord (section 83CV; Text-fig. 6.1).

Poor exposure hampers detailed study of the Bird Fiord Formation north of Schei syncline. Comparison of the sections at Bird Fiord with sections just southwest of the


Member D
unit 5
unit 4
unit 3
unit 2
unit 1
Member F
BIRD FIORD FORMATION
480
355
270
245
15
220
110
DATUM TOP BLUE FIORD FM
81E
81F
83CV
BLUE FIORD FORMATION
79SF


0 KILOMETERS 50
NORWEGIAN BAY
GRAHAM ISLAND
SVENDSEN PENINSULA
BAUMANN FIORD
VENDOM FIORD
BJORNE PENINSULA
STENKUL FD
81RR
79SF
EIDS FD
BLUE FD
BIRD FD
81E 81F
83CV
OKSE BAY
83GRF2
83GRF1
ELLESMERE ISLAND
NORTH KENT I
CARDIGAN STRAIT
HELL GATE
81H
81G
82C
82C1
79GF
82A-A3
82B-B2
82B4
82B3
83A
83B
SOUTH CAPE FD
DEVON ISLAND
JONES SOUND
PK = Pander and Kl

10


STRATHCONA FIORD FORMATION
RMATION
79SF
81RR
300
200
100
0
METERS
0
KILOMETERS
10

N
MAKINSON INLET
GRF2
83GRF1

Text-figure 6.1: Stratigraphic cross-section, area E in text-figure 4.1 (Bird Fiord to Baumann Fiord, Ellesmere Island).

2 of 2

head of Sor Fiord (section 79SF) and Stenkul Fiord (section 81RR) indicate significant on-strike thickness and facies variation. At section 79SF in the environs of Sor Fiord the sedimentological style of the entire formation (220 meters thick) is similar to that of the lower 450 meters at Bird Fiord. Red evaporitic shales, siltstones and sandstones of the Strathcona Fiord Formation (attributed to the upper member of the Bird Fiord Formation in G.S.C. Map 1312A) overlie this interval at this locality. The contact is covered, but is apparently conformable.

East of Sor Fiord, lithologies typical of the Strathcona Fiord Formation lie directly upon Blue Fiord Formation carbonates (McGill, 1973, 1974; Roblesky, 1979; Rice, 1982). McGill (1973, 1974) considered this contact to be unconformable, based on observations in a section exposed on the west side of the promontory between Sor and Stenkul fiords. This locality, however, appears to be anomalous. Roblesky (1979, p. 75) cites localities east of those of McGill and states that the contact appears conformable in all of these. This is corroborated by R. Thorsteinsson (pers. comm. 1984) who considers, on the basis of considerable fieldwork in the area, that the contact between the Blue Fiord/Disappointment Bay Formation and the Strathcona Fiord Formation is conformable in the region of Vendom, Sor and Stenkul Fiords. Rice (1982) did not comment on the nature of this contact at Stenkul Fiord (section 81RR; Text-fig. 6.1).

Bird Fiord area

Description

The boundary between bioclastic, micritic limestones of the uppermost Blue Fiord Formation and the basal shales and argillaceous siltstones of the Bird Fiord Formation is readily apparent on air photographs. Distinct changes in slope and ground colour (from light grey to brown) between the resistant carbonates of the Blue Fiord Formation and the semi-recessive, and mainly clastic Bird Fiord Formation highlight this abrupt, but seemingly conformable contact.

The lower 230 meters of the Bird Fiord Formation (Member F unit 1) outcrops as a series of variably resistant ridges of impure limestones and calcareous siltstones separated by recessive suboutcropping or covered shales and argillaceous siltstones. These lithologies are arranged in coarsening/cleaning upward rhythms 3 to 10 meters thick. The types of rhythms present are best described as variations on a shale → bioturbated siltstone → bioclastic, rubbly, very calcareous siltstone → current-bedded, calcareous siltstone sequence (Pl. 29, fig. 1). Limestones occur locally at the tops of these rhythms.

230-255 meters above the base of the formation (member F unit 2; Text-fig. 6.1) the rhythms change character to consist of shale → planar laminated, argillaceous siltstone with variably rubbly-bedded siltstone or cryptalgal laminite at the top (Pl. 29, fig. 6). Several bedding planes show current oriented domal stromatolites (Pl. 29, figs 3, 4).

The succeeding 90 meters (member F unit 3 in Text-fig. 6.1) is patchily exposed. Coarsening/cleaning upward rhythms are present and consist either of shale → bioturbated siltstone → variably impure limestone or of shale → bioturbated siltstone → very calcareous sandstone with large horizontal trace fossils.

The remaining 110 meters of section 81E shows a reduction in limestones and the local introduction of thin, non-calcareous sandstones into repetitive, coarsening-upward rhythms of shale → argillaceous siltstone → calcareous, cross-laminated and bioturbated, calcareous sandstone. Shale → silty shale coarsening up rhythms are locally capped abruptly by one meter thick rubbly-bedded, very sandy limestones. Locally these limestones are massive and possess birdseye texture. Small scale channelling (2-3 meters across; 0.5-1.0 meters deep) is present. Loose sandstone flags show linear and interference rippling, and current lineation.

Section 81F overlaps section 81E by approximately 85 meters. Exposure in section 81F is poor, but permits the recognition of a change in sedimentological style approximately 490 meters above the base of the formation. The coarsening/cleaning upward rhythms of member F unit 4 are replaced by a poorly exposed interval (member F unit 5 Text-fig. 6.1) of sharply bounded variably bioclastic calcareous sandstones 0.5 to 1.0 meter thick separated by covered intervals of variable thickness (apparently underlain by shales and argillaceous lithologies). Sandstones become increasingly bioclastic upsection.

Member F unit 5 is overlain by felsenmeer suboutcrop of planar-bedded and cross-stratified non-fossiliferous, dominantly non-calcareous tan-coloured sandstones (member D Text-fig. 6.1). Member D sandstones in the vicinity of Bird Fiord are similar to those of member D south of the Schei syncline. The boundary between members F and D roughly corresponds to the boundary between the lower and upper members of the Bird Fiord Formation as mapped by the G.S.C. in Map 1312A.

Viau (pers. comm., 1983) measured a section through the uppermost part of the Bird Fiord Formation at the type section. Viau's measured section is incorporated into the results of this thesis (section 83CV in Text-fig. 6.1). The uppermost 220 meters of the Bird Fiord Formation at this locality consist of variably calcareous, generally non-fossiliferous, cross-bedded sandstones. Exposure is very poor. The conformable upper contact with channelled cross-bedded red siltstones and fine sandstones of the Strathcona Fiord Formation is exposed.

Interpretation

The presence of marine conditions during the deposition of member F unit 1 is indicated by corals and brachiopods. Preferred orientation of tentaculitids, small scale scouring and ripple cross-lamination, indicate low to medium current energy. Sedimentologically, member F unit 1 resembles member F unit 3 in which small scale channelling and interference rippling occurs near the tops of the coarsening/cleaning upward rhythms. The carbonate caps to these rhythms locally show birdseye texture indicating shallow subtidal cementation, or deposition in intertidal water conditions (Shinn, 1983). Member F unit 2 probably was deposited in a very shallow intertidal setting. This is indicated by the presence of planar laminated siltstones similar to those seen in member A south of Schei syncline, and by the presence of current oriented domal stromatolites on exposed bedding planes (Pl. 29, figs. 2, 3, 4). Member F units 1, 2 and 3 represent deposition in a very shallow, intermittently restricted, shelf setting.

The impure carbonate coarsening-up rhythms and the non-calcareous sandstones which exhibit shallow channelling, rippling and current lineation in Member F unit 4 indicate a shallow lagoonal setting. Repetitive, regressive lagoonal sequences periodically were capped by sandstones from a local non-marine source. Member F unit 5 is too poorly exposed to discuss in detail. However, this interval can be viewed as a large scale (90 meters thick) coarsening/shoaling upward sequence. The argillaceous member F unit 5 represents distal delta deposits - possibly longshore from the main region of clastic input. The upward increase in sandstones in the section records the increase in proximity of the delta. The non-calcareous, non-bioclastic nature of the lower part of member D may be indicative of minimal marine reworking of fluvial sands. Parts of member D may be fluvial. The intercalation of brachiopod-rich calcareous sandstone horizons with non calcareous sandstones in the uppermost 150 meters of Member D in the type section (83CV in Text-fig. 6.1) suggests an interface environment.

Summary

The lower four units of member F of the Bird Fiord Formation at Bird Fiord represent shallow, intermittently restricted, shelf sedimentation. Clastic sediment supply to the Bird Fiord area during the deposition of these units was intermittent and indirect. Member F unit 5 and member D record the introduction and advance of a direct clastic source to the area.

S.W. Sor Fiord

Discussion

A poorly exposed section was measured through most of the Bird Fiord Formation 12 kilometers west-southwest of the head of Sor Fiord (section 79SF Text-fig. 6.1). The contact with the underlying carbonates of the Blue Fiord Formation is covered, but apparently is conformable. The Bird Fiord Formation at this locality is approximately 220 meters thick. It outcrops as a series of resistant sparsely fossiliferous, rubbly-bedded, impure limestone and calcareous sandstone ridges separated by recessive argillaceous intervals. This outcrop pattern reflects the presence of repetitive coarsening upward rhythms. Poor exposure negates detailed discussion. The lithologies and outcrop pattern are similar to those of Member F unit 1 of the Bird Fiord area and appear to represent deposition in a shallow shelf to lagoonal setting.

The upper 30 meters of the Bird Fiord Formation is not exposed. The contact with the overlying evaporitic red siltstones and sandstones of the Strathcona Fiord Formation (Pl. 29, fig. 7) is apparently conformable.

East of Sor Fiord

Discussion

McGill (1973, 1974) cited and illustrated a locality immediately east of the mouth of Sor Fiord where Blue Fiord/Disappointment Bay Formation carbonates are unconformably overlain by gypsiferous red siltstones and sandstones of the lower member of the Okse Bay Group (the Strathcona Fiord Formation of this study). Immediately east of the head of Stenkul Fiord gypsiferous red shales, siltstones and silty sandstones of the Strathcona Fiord Formation rest on biohermal carbonates of the Blue Fiord Formation (Rice, 1982, section S2). The contact between these two formations at these localities herein is considered conformable for reasons discussed previously.

West of Vendom Fiord

Discussion

Brief reconnaissance of stream cuts in the sloping land separating Vendom Fiord from the range of mountains west of the fiord indicates the presence of a very thin tongue of fossiliferous Bird Fiord Formation facies (impure rubbly bedded carbonates) separates carbonates of the upper member of the Blue Fiord Formation (Robleski, 1979; Jones, 1982: termed 'lower member of the Bird Fiord Formation' by McLaren, 1963 and McGill, 1973, 1974) from basal redbeds of the Strathcona Fiord Formation (see appendix maps).

East of Vendom Fiord

Discussion

Carbonates of the Blue Fiord/Disappointment Bay Formation are overlain directly by reddish weathering locally evaporitic shales, siltstones, fine sandstones and limestones of the Strathcona Fiord Formation in the country immediately east of Vendom Fiord (McGill, 1973, 1974 with revised terminology; Roblesky, 1979; Thorsteinsson 1984, pers. comm.). The contact between the two formations becomes unconformable to the north and east of Vendom Fiord (Thorsteinsson 1984, pers. comm.). The Bird Fiord Formation is absent north of Vendom Fiord (Trettin 1978).

B. GRINNELL PENINSULA AND BATHURST ISLAND

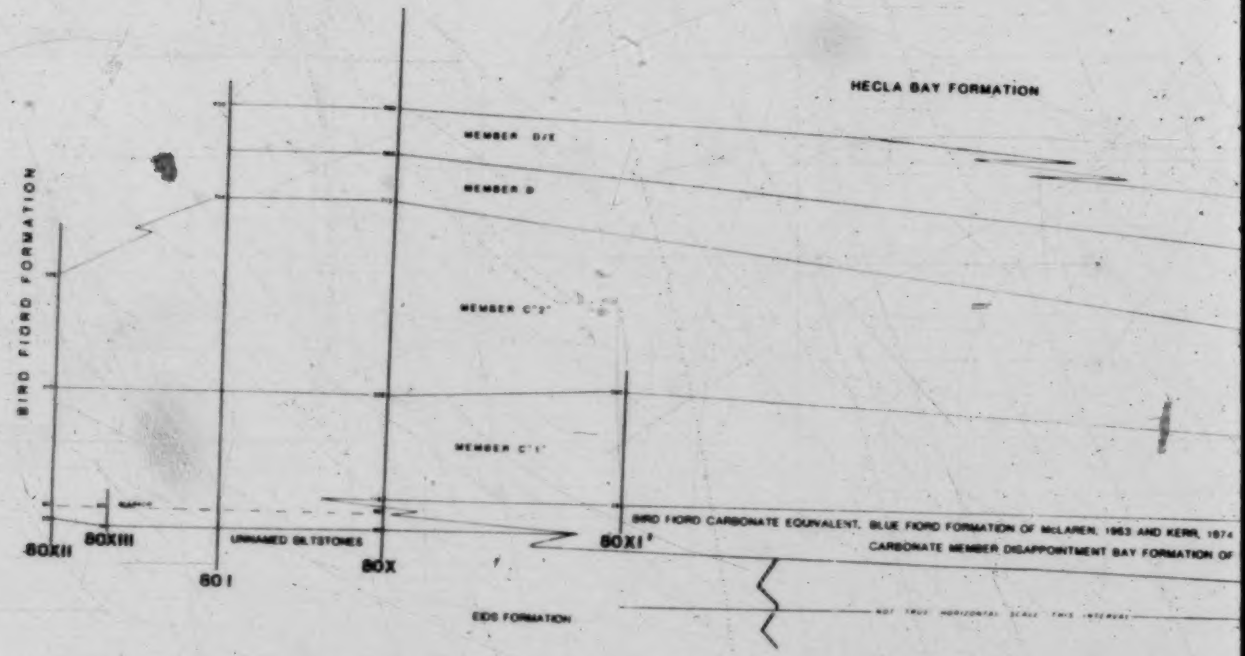
Grinnell Peninsula

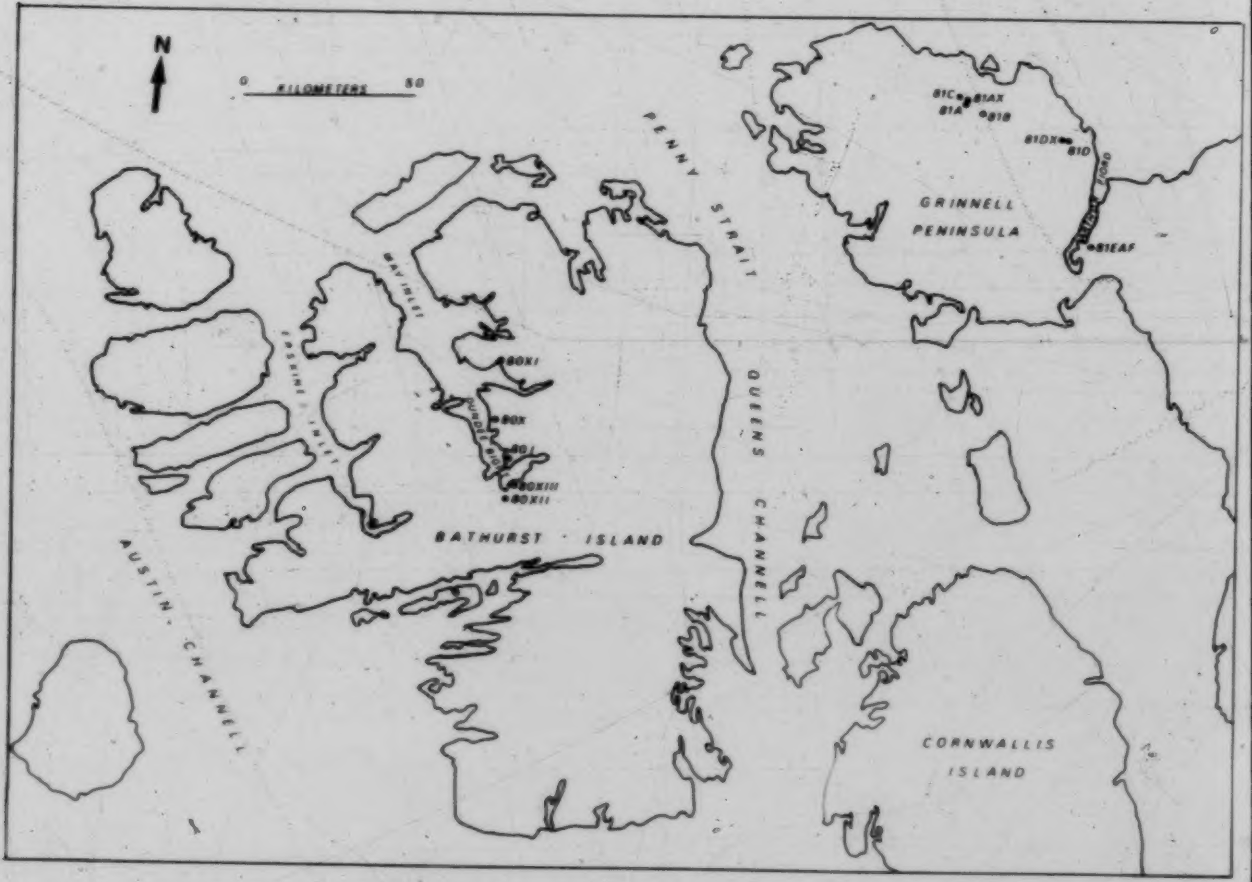
Introduction

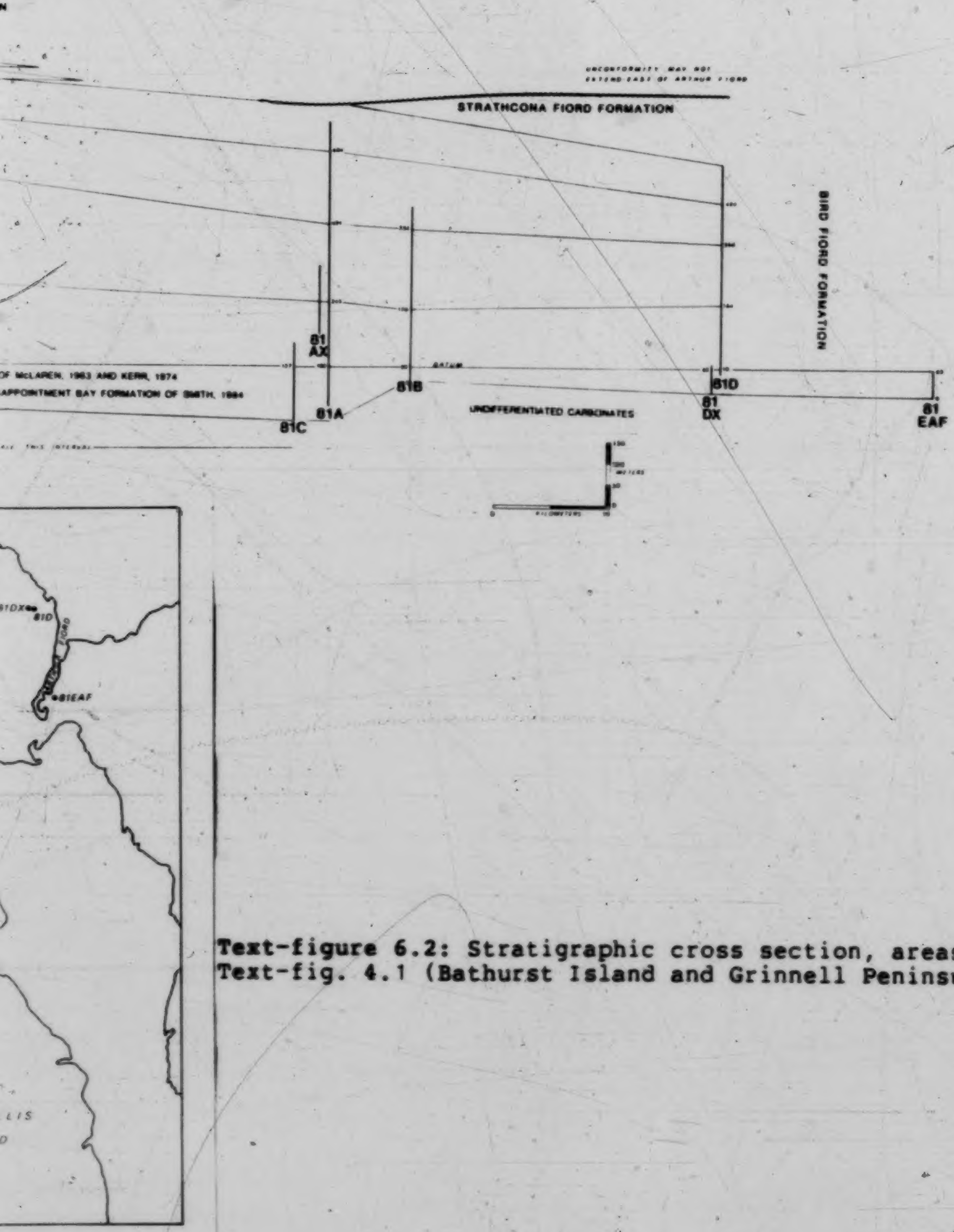
The Bird Fiord Formation is poorly exposed on Grinnell Peninsula. The sections measured (sections 81A, 81AX, 81B, 81C and 81D and 81DX, 81EAF; Text-fig. 6.2) occur in slightly incised stream valleys in rolling terrain. From the air the Bird Fiord Formation has a characteristic striped appearance which reflects repetitive coarsening-upward rhythms of shale → siltstone → sandstone. The finer grained portions of the rhythms are rarely exposed; the more resistant light colored sandstones weather as low ridges commonly veneered with felsenmeer. Bluffs 5-10 meters high locally permit examination of the sedimentology. More commonly loose, very locally derived, felsenmeer suboutcrop indicates the nature of the underlying bedrock.

Description

On Grinnell Peninsula, the Bird Fiord Formation conformably overlies dolomitic limestones variably assigned to the uppermost unit of undivided Devonian carbonates (Morrow and Kerr, 1977) and to the limestone member of the Disappointment Bay Formation (Smith, 1984). The basal part of the formation is dominated by argillaceous lithologies. This argillaceous content decreases upsection, whereas non-calcareous sandstones increase upsection to the near


HECLA BAY FORMATION
BIRD FIORD FORMATION
MEMBER D/E
MEMBER D
MEMBER C"2"
MEMBER C"1"
BIRD FIORD CARBONATE EQUIVALENT, BLUE FIORD FORMATION OF McLAREN, 1963 AND KERR, 1974
CARBONATE MEMBER DISAPPOINTMENT BAY FORMATION OF
UNNAMED SILTSTONES
EIDS FORMATION
NOT TRUE HORIZONTAL SCALE THIS INTERVAL
80XII
80XIII
80I
80X
80XI?


N
0 KILOMETERS 50
PENNY STRAIT
QUEENS CHANNEL
AUSTIN CHANNEL
BAY INLET
ERSKINE INLET
GRINNELL PENINSULA
BATHURST ISLAND
CORNWALLIS ISLAND
FIORD
81C
81AX
81A
81B
81DX
81D
81EAF
80XI
80X
80I
80XIII
80XII


UNCONFORMITY MAY NOT
EXTEND EAST OF ARTHUR FIORD
STRATHCONA FIORD FORMATION
BIRD FIORD FORMATION
DATUM
F McLAREN, 1963 AND KERR, 1974
APPOINTMENT BAY FORMATION OF SMITH, 1984
81
AX
81A
81B
81C
81D
81
DX
81
EAF
UNDIFFERENTIATED CARBONATES
METERS
KILOMETERS
81DX
81D
81EAF

Text-figure 6.2: Stratigraphic cross section, areas A and C, Text-fig. 4.1 (Bathurst Island and Grinnell Peninsula).

2 of 2

exclusion of calcareous sandstones at the top of the Bird Fiord Formation. Shelly faunas become rarer up section, with brachiopods being replaced by bivalves as the dominant shelly element. Plant fossils are present in some of the non-calcareous sandstones.

Red siltstones of the Strathcona Fiord Formation abruptly overlie the uppermost light colored sandstones of the Bird Fiord Formation at section 81D (Pl. 31, fig. 7). The Strathcona Fiord Formation is not present west of Ensorcellement River. It may have been eroded during a local unconformity underlying sandstones of the the ?Hecla Bay Formation on western Grinnell Peninsula and ?Cornwallis Island or a normal facies transition may exist. More fieldwork is needed to determine the exact relationship between these units.

The Bird Fiord Formation on Grinnell Peninsula (600 meters thick) comprises two members, each with two constituent units (Text-fig. 6.2). The lowest 150 meters of the formation (member C unit 1) consists of ridges of steel grey, silty, argillaceous, rubbly limestones and calcareous siltstones separated by recessive intervals of subcropping silty shale. These lithologies occur in 'cleaning upward' rhythms with a basal silty shale grading upwards into very silty limestones. The capping limestones are variably rubbly bedded (Pl. 30, fig. 1). Articulated brachiopods are common to abundant. Crinoid ossicles, fish teeth and orthoconic nautiloids are also present.

These cleaning upward rhythms are replaced up section by approximately 180 meters of sandier coarsening-upward rhythms of silty shale → argillaceos siltstone → silty sandstone → fine sandstone (member C unit 2). These 3-6 meter thick rhythms are similar to those in member C on southwest Ellesmere Island though the rocks are considerably more argillaceous (which explains their recessive weathering characteristic), the rhythms are thicker, and lack corals. Outcrop generally is limited to the upper parts of these rhythms. The capping sandstones are of two types; calcareous, bioclastic sandstones and non-calcareous sandstones. Both sandstone types can occur interstratified in the same ridge and show pervasive cross-bedding and cross-lamination (Pl. 30, figs. 2-6). Bioturbation is most noticeable in the non-calcareous sandstones; crumbly weathering of the calcareous sandstones likely masking the presence of bioturbation. Common herringbone cross-lamination (Pl. 30, fig. 6; Pl. 31, fig. 2) indicating current reversal, suggests a tidal influence. Small scale channelling, current lineation and large scale asymptotic cross bedding (Pl. 31, fig. 1) attest to redistribution of sediment by active currents. The cross-bedded sandstones probably represent tidally influenced marine shoals and migrating bars. They resemble outcrops of the Permian Rancho Rojo member of the Schnebly Hill Formation in Arizona attributed to marine sandwaves by Blakey (1984). Individual sandstone intervals appear to have a sheet-like geometry.

They can be seen to be extensive on air photographs and many are correlatable between sections.

There is no clear distinction of members C and D as recognised on southwest Ellesmere Island. Very poor outcrop negates detailed discussion of the uppermost 220 meters of the formation. Non-calcareous sandstone noticeably increases in importance approximately 300 meters above the base of the formation. Strata above this are assigned to a modified member D of the reference area. Talus description coupled with scattered outcrops (best seen at section 81D) of member D suggests a two-fold division. Member D unit 1 (150 meters thick) consists of locally outcropping cross bedded and cross laminated, variably calcareous, generally unfossiliferous, sandstones. Member D unit 2 (70-100 meters thick) comprises cross bedded and channelled generally non-calcareous, locally kaolinitic, sandstones with scattered bivalve coquinoid layers. Small channels with shale rip up clasts and lags are common (Pl. 31, fig. 6). This uppermost interval (unit 2 member D) is intermediate in character to Members D and E on southwest Ellesmere Island.

Interpretation

Depositional environments for the Bird Fiord Formation on Grinnell Peninsula are discussed in association with similar, but better exposed sequences on Bathurst Island.

Bathurst Island

Introduction

The Bird Fiord Formation is well exposed in cliff and stream sections along the shores of Dundee Bight, central Bathurst Island (Plate 32). Elsewhere, the Bird Fiord Formation is recessive and weathers as low terrain. As on Grinnell Peninsula, the formation is recognisable on air photographs by its characteristic striped appearance. Five sections were measured on Bathurst Island (sections 80I, 80X, 80XI, 80XII and 80XIII; (Text-fig. 6.2).

Description

The Bird Fiord Formation on central Bathurst Island is 900 meters thick. It is broadly similar in sedimentology to the formation on Grinnell Peninsula where it is 600 meters thick. This thickness change occurs on east central Bathurst Island (Kerr, 1974. p. 46).

The evaporitic and carbonate member A of the reference area D in Text-fig. 4.1) (S.W. Ellesmere Island) is not present. Carbonates 0-20 meters thick herein termed the 'Bird Fiord Formation carbonate equivalent' (assigned to the Blue Fiord Formation by Kerr, 1974; the limestone member of the Disappointment Bay Formation by Smith, 1984) separate the Bird Fiord Formation from siltstones and shales of the Eids Formation (terminology of Embry and Klovan, 1976) on central Bathurst Island. This carbonate unit pinches out westwards, and is present only in some of the sections measured on Bathurst Island (sections 80XI, 80X). These rubbly limestones and calcareous siltstones resemble the facies described from Member B of the reference area (area D of Text-fig. 4.1) and the rubbly impure limestones seen at the top of the carbonate unit underlying the Bird Fiord Formation, and capping rhythms in member C unit 1 of the Bird Fiord Formation, on Grinnell Peninsula.

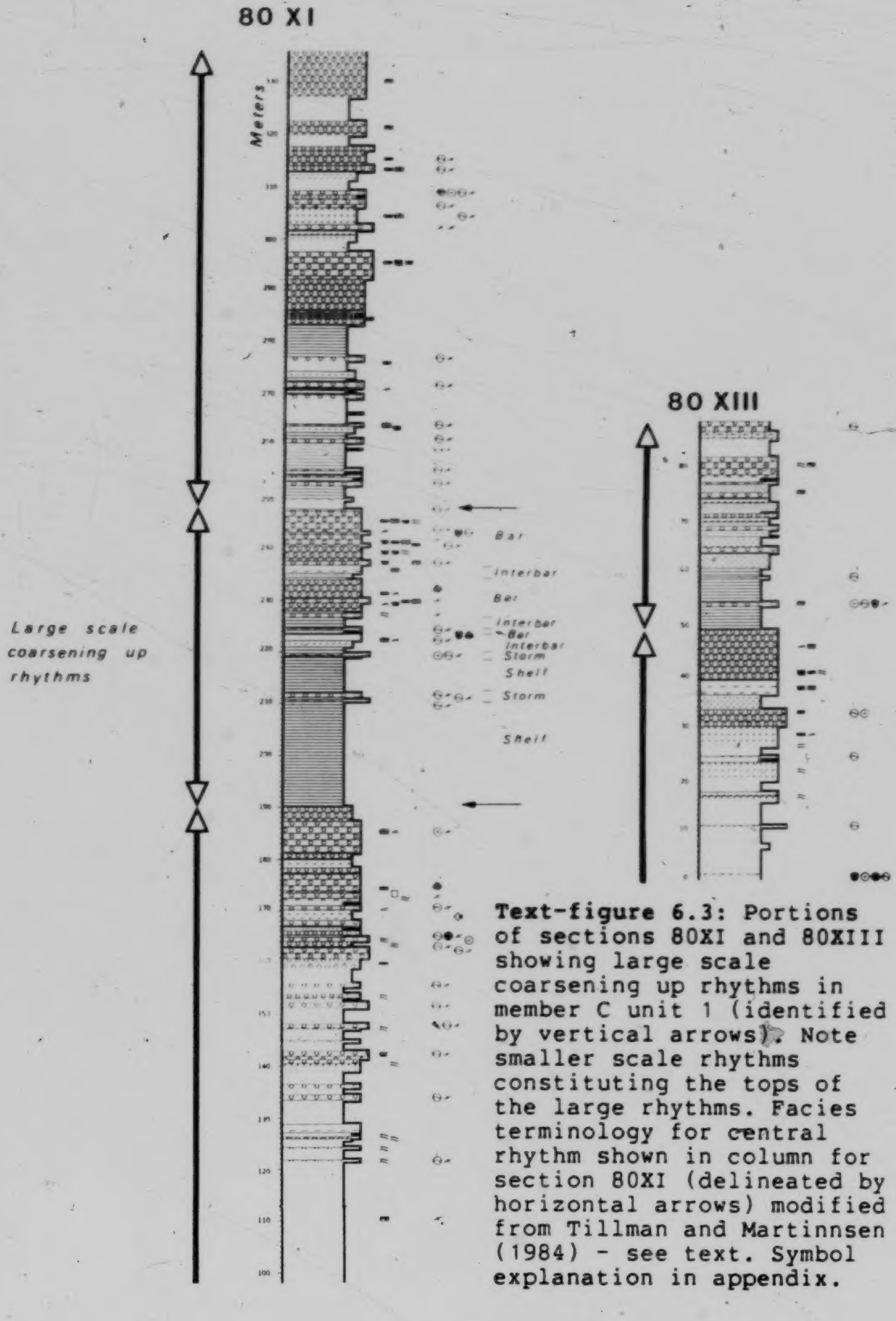
The Bird Fiord Formation is conformably overlain on central Bathurst Island by light yellow to buff weathering sandstones of the Hecla Bay Formation. The Strathcona Fiord Formation pinches out (possibly due to a local unconformity on western Grinnell Peninsula, Cornwallis Island and ?eastern Bathurst Island) between Tucker River, Grinnell Peninsula (section 81D) and Cornwallis Island (Thorsteinsson and Kerr, 1968).

The Bird Fiord Formation on Bathurst Island is clastic. It comprises two members, C and D, which are subdivided like members C and D on Grinnell Peninsula (Text-fig. 6.2; Pl. 32). On Bathurst Island the thickness of each of these members exceeds that of their lithostratigraphic correlatives on S.W. Ellesmere Island and Grinnell Peninsula (Text-figs. 6.2, 7.1).

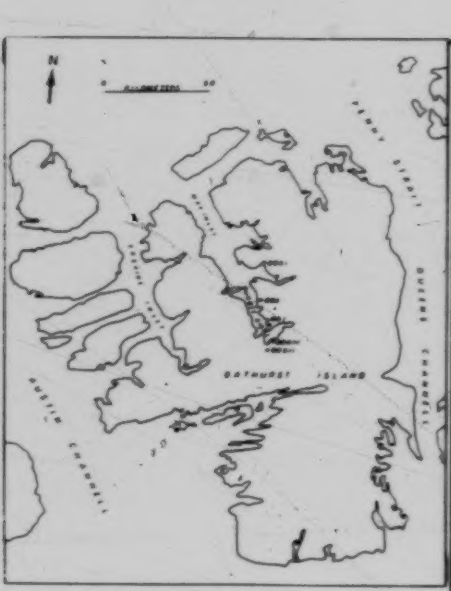
The basal 220 meters of the Bird Fiord Formation (member C unit 1), dominated by shale and silty shale, is characterized by large scale coarsening-upward rhythms 50 to 100 meters thick (Text-figure 6.3). These rhythms, correlatable between sections (Text-fig. 6.4), are composed of a recessive silty shale-rich base which, through increasing calcareous siltstone and sandstone interbeds, grades into semi-prominent bluffs of calcareous silty sandstones (Text-fig. 6.3; Pl. 33, fig. 1; Pl. 35, fig. 1).

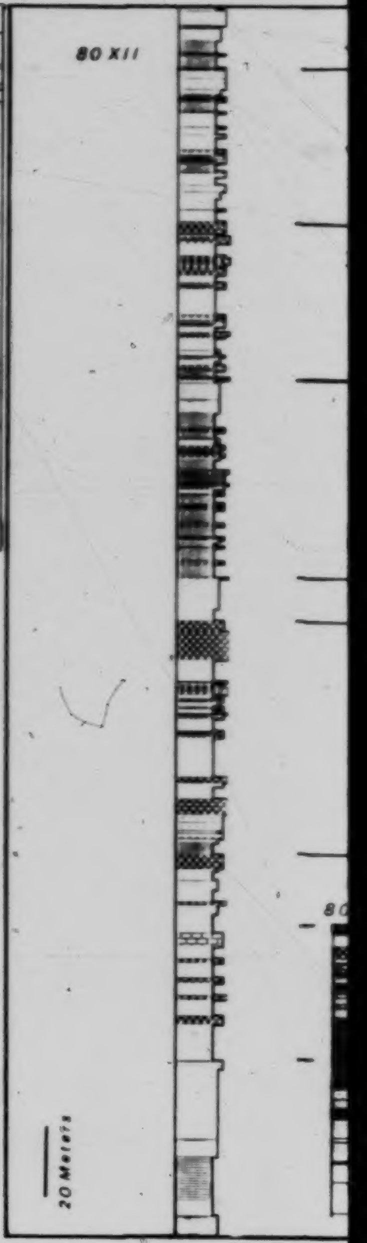
The basal portion of these rhythms consists of recessive lithologies (shale and argillaceous siltstone) which contain bioclastic sandstone beds with sharp lower and upper contacts (Pl. 33, fig. 2). Original sedimentary structures in these sandstones have been largely destroyed by bioturbation. Coarsening-upward rhythms 2 to 5 meters thick of silty shale → argillaceous siltstone → calcareous fine sandstone can make up the bluff forming uppermost portion of the larger scale rhythms (Pl. 33, fig. 3; Pl. 34, fig. 5). Alternatively, the large scale rhythms can be capped by sharp-based, massive to rubbly-bedded, calcareous siltstone/silty limestone beds 50 centimeters to 1.5 meters thick interbedded with silty shale horizons of similar thickness. Locally, abundant brachiopod faunas are associated with the capping sandstones/silty limestones. Complete (rolled) dechenellid trilobites were found in these beds in section 80XII.

Net argillaceous content decreases upsection. 220-595 meters above the base of the formation in section 1980X (member C unit 2) repetitive coarsening upward rhythms 2-8 meters thick of shale → argillaceous siltstone → calcareous sandstone become the dominant style of facies succession (Pl. 35, fig. 3). This sedimentological style resembles that

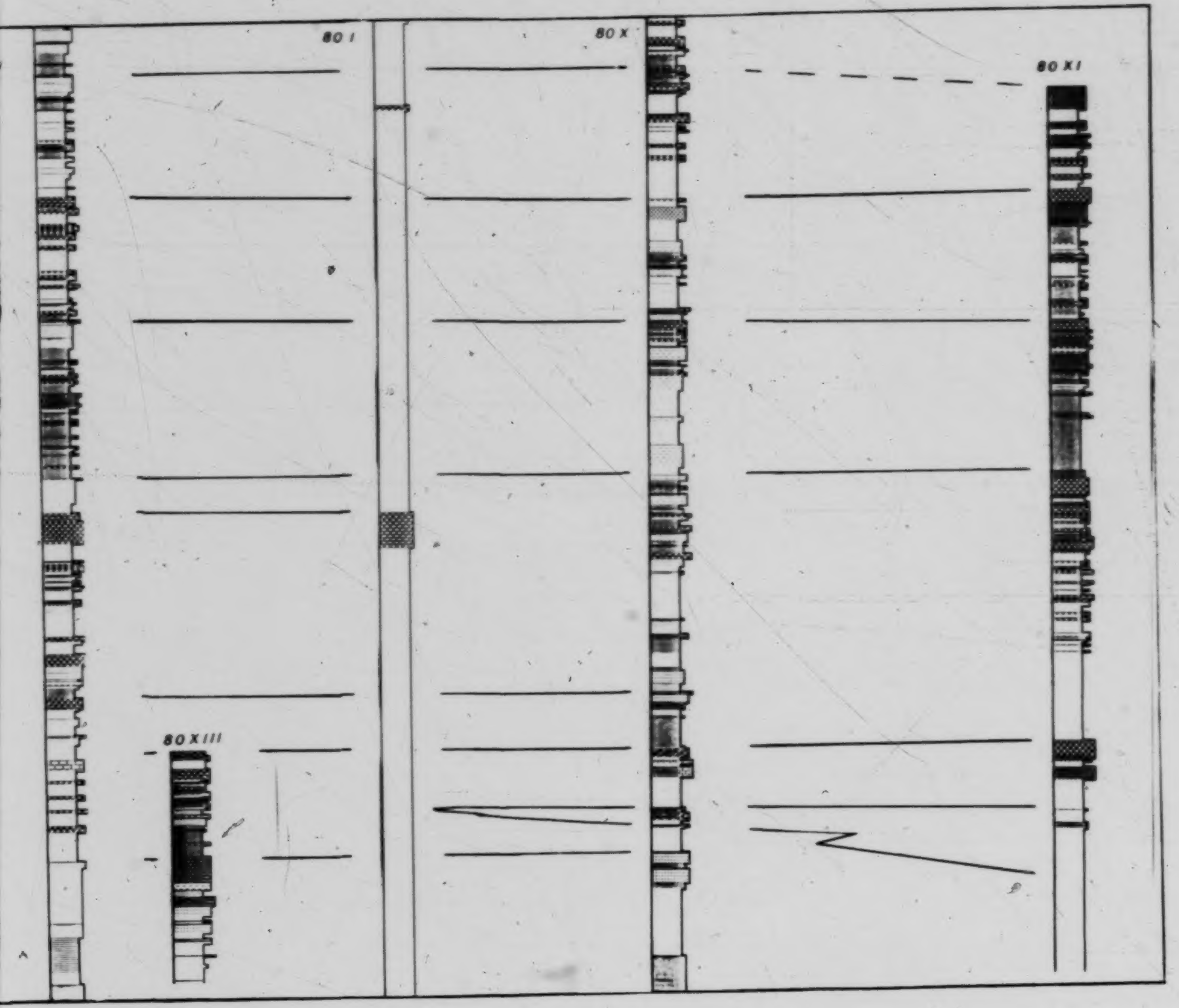

80 XI
80 XIII
Meters
Large scale coarsening up rhythms
Bar
Interbar
Bar
Interbar
Bar
Interbar
Storm
Shelf
Storm
Shelf

Text-figure 6.3: Portions of sections 80XI and 80XIII showing large scale coarsening up rhythms in member C unit 1 (identified by vertical arrows). Note smaller scale rhythms constituting the tops of the large rhythms. Facies terminology for central rhythm shown in column for section 80XI (delineated by horizontal arrows) modified from Tillman and Martinnsen (1984) - see text. Symbol explanation in appendix.


N
BATHURST ISLAND
PENNY STRAIT
QUEENS CHANNEL
AUSTIN CHANNEL


80 XII
20 Meters
80

Text-figure 6.4: Correlation between lower portions of sections 80XII, 80XIII, 80I, 80X and 80XI showing large scale coarsening-up rhythms and the continuity of these rhythms between sections. Symbol explanation in appendix.


80 I
80 X
80 XI
80 XIII

2 of 2

of member C in the Ellesmere reference area and member C unit 2 on Grinnell Peninsula. A masked larger scale rhythmicity is still present (Pl. 32). The basal contact of the shale with the underlying sandstone capping the preceeding rhythm is sharp (Pl. 34, fig. 6), but apparently not erosive. Silt stringers become more abundant uprhythm so the basal shale grades into an argillaceous siltstone. Sedimentary stuctures have been largely obliterated by intense horizontal and vertical bioturbation; however planar lamination, ripple cross-lamination and fine sand-filled small scale scours indicate low to medium current energies. The contact between the bioturbated siltstones and the overlying calcareous sandstones can be sharp and erosive, or gradational over 5-10 centimeters (Pl. 35, figs. 2, 3). Rippling, planar and asymptotic cross bedding and small scale channelling typify these sandstone beds (Pl. 34, figs. 2, 4; Pl. 35, fig. 4). Planar laminated current lineated intervals are present, but rare (Pl. 34, fig. 7). Current winnowed bioclastic pockets rich in mainly articulated brachiopods are common. The undersurfaces of flags show abundant trace fossils. Color banding of red/brown and grey/green in these units is common, this reflecting variable calcareous cement content.

The boundary between members C and D on Bathurst Island is marked by the introduction of sandstone intervals 10-15 meters thick (Pl. 32; Pl. 36 figs. 1, 2). The incoming of these sandstones, and the nature of these units differs between sections 80X and 80XII. In section 80X these flaggy weathering thick sandstone intervals have sharp, possibly slightly erosive, contacts with underlying shales (Pl. 36, fig. 1). A rhythmic pattern (50 centimeters to 1 meter thick) of thick-bedded to thin-bedded sandstones occurs through most of these intervals. The uppermost 1 to 2 meters are generally cross-bedded; thin shale stringers occur between sandstone beds and small scale scours are locally lagged by shale rip-up conglomerates. Intervals of successive 3-5 meter thick coarsening upward rhythms similar to those characteristic of member C unit 2 separate the thick sandstones.

Member D unit 1 in section 80XII differs from member D unit 1 in section 80X in that the sandstones are generally not planar bedded. At this locality they show large scale asymptotic cross bedding and locally low angle planar cross stratification (Pl. 36, fig. 2). Local large scale herringbone cross stratification indicates current reversal (Pl. 35, fig. 6). Interference rippling and current lineation is common on flag planes.

The uppermost 110 meters of the Bird Fiord Formation (exposed in section 80X) has a markedly different sedimentology and is assigned to an upper unit of Member D. Laterally discontinuous beds of asymptotically cross-bedded and laminated non-calcareous sandstones are cut into by a large channel in excess of 50 meters wide and approximately 6 meters deep. Channel fill and cross-bedded sandstone intervals 8-10 meters thick are separated by thinly interbedded silty sandstones and shales of similar thickness (Pl. 36, fig. 3). The latter revert locally to 3-5 meter thick coarsening-upward rhythms as seen in member C unit 2 in the Bathurst Island sections.

The boundary between the Bird Fiord Formation and the overlying Hecla Bay Formation is well exposed in section 80X. At this locality the base of the Hecla Bay Formation is placed at the base of a cross-bedded continuous white and yellow weathering unit of sandstone in excess of 50 meters thick (Pl. 32). This contact is easily seen as the color of the terrain at this point changes from brown where underlain by the Bird Fiord Formation to orange where underlain by the Hecla Bay Formation. Above this, multiple channelling in non calcareous sandstones (Pl. 36, figs, 4, 5) is apparent though outcrop is poor. The basal Hecla Bay Formation sandstones show considerable leisengangue staining (Pl. 32).

Interpretation

The Bird Fiord Formation on Bathurst Island and Grinnell Peninsula is a regressive unit which resulted from delta encroachment over a shelf setting.

The thin rubbly bedded carbonates on central Bathurst Island are similar to rubbly impure carbonates in member C unit 1 on Grinnell Peninsula. A small bioherm in this unit occurs at 80SS13, approximately 4 kilometers inland along a major stream draining westwards into Dundee Bight 5 kilometers south of Half Moon Bay, Bathurst Island (75° 53' 30" N 99° 47' W). The argillaceous nature and lateral relationships of these carbonates indicates an outer shelf or slope setting.

The large scale (50+ meters thick) coarsening-upward rhythms of member C unit 1 resemble rhythms described from the Jurassic and Cretaceous of Alberta (Cant, 1984; Beaumont, 1984), and of the U.S. (sandstones in the Redwater Shale Member of the Sundance Formation - Brenner and Davies, 1973, 1974; the Cretaceous Codell, Hygiene, Terry, Rocky Ridge, Shannon and Sussex sandstones - Brenner, 1978, 1980; Bouma *et al.*, 1981; Kitely and Field, 1984; Porter, 1976; Tillman and Martinsson, 1984). They are also somewhat similar to thickening-up rhythms in transition deposits from basinal to shelf deposits in the Carboniferous of Morocco (Graham, 1982).

Coarsening-up rhythms typical of member C unit 1 (Text-figs. 6.3, 6.4) probably are shoaling-up sequences. The shelf, interbar and bar facies of Tillman and Martinnsen (1984) are recognised with minor modifications (Text-fig. 6.3). A facies not recognised by Tillman and Martinnsen (1984) is present intercalated within the bioturbated shelf facies. Sharply bounded bioclastic sandstone beds, variably 50 cms to 1.5 meters thick are present (Pl. 33, fig. 2). Internally these sandstones are massive, or show some planar lamination and wavy bedding (hummocky cross stratification?). Sedimentary structures in many of these sandstone layers are either obliterated, or indistinct due to bioturbation. There is no obvious grading to the beds; grain size appears uniform. These units are similar to sandstones described by Hobday and Martin (1984) and Rice (1984) who attributed them to storm origin. They are in a similar sedimentological setting to 'storm generated' coquinoid sandstones in the Jurassic Sundance Formation (Brenner and Davies, 1973, 1974).

The repetitive 3-5 meter thick coarsening-upward rhythms in member C unit 2 on Bathurst Island represent shoaling sequences in a shallow shelf setting. These rhythms are similar to those in member C of the reference area. Member C unit 2 rhythms on Bathurst Island differ in being less calcareous, slightly thicker, having more obvious sedimentary structures, more gradual transitions between the lithologies in the rhythms, and in lacking a coral fauna. Composition of the brachiopod faunas also differs between the two areas (see Chapter VIII). Trough cross-stratification (Pl. 34, fig. 2), planar lamination (Pl. 34, fig. 7) and minor channelling (Pl. 34, fig. 4) in the capping sandstones indicates medium to high current energies associated with storm and fairweather sediment dispersal. Sharp bounded massive calcareous sandstone beds in these rhythmic sequences (Pl. 34, figs. 3, 5) are storm deposits.

Unit 1 member D - characterized by sandstone intervals in excess of 10 meters thick occurring in a background of repetitive coarsening-upward rhythms as seen in member C unit 2 - heralds the direct influence of a delta on the shelf. The variable calcareous content of these sandstones (commonly calcareous at their tops and bases with a non-calcareous center) appears to be associated with the degree of reworking of these sandstones by shelf processes. The calcareous cement content appears to increase with the degree of marine reworking of the sandstone. These sandstone intervals are tentatively interpreted as barrier island and nearshore bar complexes. The conjunction of low angle planar cross-stratification (beach?), large scale herringbone cross-stratification (tidal channel?) and cross-stratified interference rippled non-calcareous sandstones (tidal deltas/sandwaves?) and 5-10 meter thick bioturbated argillaceous siltstones (lagoon?) would seem to indicate a barred shoreline. More detailed work is needed for definite conclusions to be drawn. Member C unit 2 type coarsening-upward rhythms associated with these deposits represent shallow, open shelf settings in front of the barrier system. Difference in sedimentary structures associated with the thick sandstones between sections 80X and 80XII may indicate variation in tidal energy. The very common large scale cross stratification at section 80XII (Pl. 35, fig. 6) could have resulted from the presence of a tidal channel. Planar bedding in the sandstones of section 80X may reflect continuous barriers. The stratigraphically lower introduction of member D unit 1 in section 80XII as compared to that in section 80X may represent the earlier arrival of material from a clastic source to the south.

Unit 2 member D can be attributed to delta margin distributary and interdistributary environments. This conclusion is based on lithology, fossils, sedimentary structures and vertical facies relationships. The unit is well exposed (though largely inaccessible) in section 80X (Pl. 36, fig. 3).

VII. REGIONAL GEOLOGY

A. AGE DETERMINATIONS

Systematic collection of conodont samples was done to assist in correlation between measured sections of the Bird Fiord Formation. In excess of one hundred carbonate samples were acid treated; the residues separated using heavy liquid techniques, and then picked for microfossils. Eighty samples were productive. The conodonts were forwarded to Dr. T. Uyeno (Geological Survey of Canada, Calgary) for identification and age assignment. The results of subsequent reports are incorporated in this thesis (Appendix 1).

No systematic collection of argillaceous lithologies for palynological samples were done owing to the improbability of finding persons to fund preparation of the samples. However, an offer by Shell Canada Resources to process one hundred samples enabled the author to submit argillaceous and arenaceous lithological samples for preparation. The residues were forwarded to Dr. C. McGregor (Geological Survey of Canada, Ottawa). Approximately half the samples had been examined by the time of writing. The results are incorporated in this thesis (Appendix 2).

ELLESMERE ISLAND: Bird Fiord Area

The top of the Blue Fiord Formation at Blue Fiord is *serotinus* Zone (early late Emsian) in age (Uyeno and Klapper, 1980). Conodont samples from sections 81E, 81F and 79SF indicate Middle Emsian to lower Eifelian ages (*inversus* to *costatus costatus* Zones) for the lower 400 meters of the Bird Fiord Formation. Palynological dating from the same stratigraphic interval as the conodonts is in broad agreement with the conodont ages. However, the spores are slightly problematical because there is evidence of reworking, and several samples show anomalously young ages (late Eifelian to Early Givetian) in comparison to the conodont determinations. The reasons for this are unclear, and an explanation is beyond the scope of this thesis. The upper portion of the formation (member D) was not dated due to the lack of exposure of suitable lithologies for palynology.

ELLESMERE ISLAND: North Kent Island to Grise Fiord

The Blue Fiord/Disappointment Bay Formation has been dated as being at least as young as Late Dalejan (*inversus* to *serotinus* Zones. Uyeno *in* Smith, 1984; Chatterton *in* Jones, 1982; Chatterton *in* Smith, 1984). Two additional samples were obtained during the course of this study from near the top of this formation on northwest Devon Island (samples NI8 and NI9). These indicate *inversus* to *serotinus* Zone ages.

A considerable number of conodont samples were prepared from member A unit 3, member B and lower member C of the Bird Fiord Formation. The conodonts recovered indicate a *costatus costatus* Zone age for member B and part of member C. A single conodont sample approximately half way up member C in section 81H (spot sample ENK 14) indicates a lower

Eifelian age (*patulus* to *kockelianus* Zones) of deposition for the upper portion of member C in this area.

These age determinations bracket member A deposition as ranging from the *serotinus* to *patulus* Zones (Late Emsian to Early Eifelian). Member D deposition, by inference, probably occurred from the Middle to Late Eifelian.

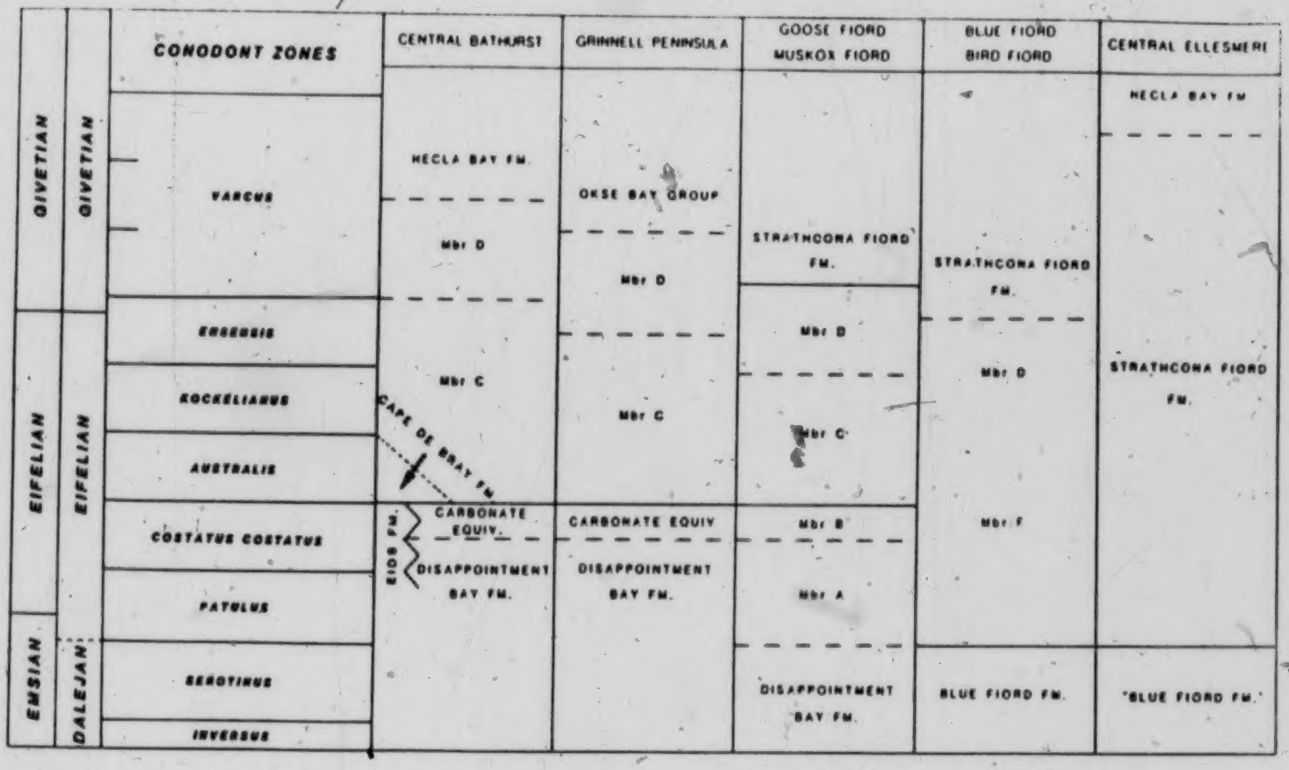
GRINNELL PENINSULA

The carbonates underlying the Bird Fiord Formation in this area were sampled for conodonts in an attempt to date the incoming of the conformably overlying clastic Bird Fiord Formation. The upper beds of this carbonate unit contain *inversus* to *costatus costatus* Zone conodonts. These carbonates are thus broadly coeval with member B of the Bird Fiord Formation on southwest Ellesmere Island. No palynological dating is available.

BATHURST ISLAND

Age determinations using conodonts is available from carbonate lithologies underlying the clastic Bird Fiord Formation. These carbonates (Blue Fiord Formation of Kerr, 1974; carbonate member of the Disappointment Bay Formation of Smith, 1984) contain conodonts indicative of a late early Eifelian (*costatus costatus* Zone) age. Thus they appear to be coeval with those carbonates underlying the Bird Fiord Formation on Grinnell Peninsula.

The palynological evidence is in agreement with the conodont age determinations, indicating that the Eifelian/Givetian boundary lies in member C unit 2 in


GIVETIAN
EIFELIAN
EMSIAN
GIVETIAN
EIFELIAN
DALEJAN
CONODONT ZONES
VARCUS
ENSENSIS
KOCKELIANUS
AUSTRALIS
COSTATUS COSTATUS
PATULUS
SEROTINUS
INVERSUS
CENTRAL BATHURST
HECLA BAY FM.
Mbr D
Mbr C
CAPE DE BRAY FM
CARBONATE EQUIV.
EIDS FM.
DISAPPOINTMENT BAY FM.
GRINNELL PENINSULA
OKSE BAY GROUP
Mbr D
Mbr C
CARBONATE EQUIV
DISAPPOINTMENT BAY FM.
GOOSE FIORD MUSKOX FIORD
STRATHCONA FIORD FM.
Mbr D
Mbr C
Mbr B
Mbr A
DISAPPOINTMENT BAY FM.
BLUE FIORD BIRD FIORD
STRATHCONA FIORD FM.
Mbr D
Mbr F
BLUE FIORD FM.
CENTRAL ELLESMERE
HECLA BAY FM
STRATHCONA FIORD FM.
"BLUE FIORD FM."

sections 80XI and 80XII. McGregor and Uyeno (1972) and Ormiston (1967) placed this boundary slightly lower in the formation in sections to the east of those reported in this study. The Bird Fiord Formation on Bathurst Island thus appears to range from the early Eifelian into the Givetian.

B. REGIONAL CORRELATION

The Bird Fiord Formation displays distinct regional inhomogeneity. Facies changes occur on Ellesmere Island in a north-south direction across Schei syncline between the type area at Bird Fiord and the Goose Fiord to Muskox Fiord region. Facies changes are also apparent in an east-west direction from Ellesmere Island to Grinnell Peninsula to Bathurst Island (Text-figs. 7.1 and 7.2 in rear pocket).

Due to the differences in stratigraphy between these areas, a combination of techniques have been used to construct regional cross sections (Text-figs. 7.1 and 7.2) and paleogeographic maps (Text-figs. 7.3-7.9). Techniques include 1. lithostratigraphic correlation, 2. biostratigraphic correlation, and 3. event correlation.

Where possible, intervals of similar lithologies in adjacent sections have been correlated in the regional lithostratigraphic cross-sections. This technique is relatively simple to use in areas where the stratigraphy is continuous - such as in the reference area D of southwest Ellesmere Island.

A combination of biostratigraphic and event correlation has been used to correlate between areas with dissimilar stratigraphy. The conodont information obtained in this study suggests that the carbonate units immediately underlying the Bird Fiord Formation on Bathurst Island and Grinnell Peninsula are synchronous, and can be broadly correlated with members B and C on northwest Devon Island, North Kent Island and southwest Ellesmere Island. However the conodont dating resolution is not detailed enough to be of help in correlation between the Bird Fiord area and Goose Fiord areas of southwest Ellesmere Island. In this situation event correlation is of use.

Event correlation is based on the correlation of corresponding peaks of sedimentary cycles which are presumed to be synchronous (Ager, 1973). Krumbein and Sloss (1963) described correlation by

> '..."position in bathymetric cycle" in which points of maximum submergence in transgressive-regressive cycles are correlated, despite maximum submergence which can be represented by different facies in different places'

Dixon *et al*. (1981) used this technique to correlate between largely unfossiliferous lithologies, utilizing sand peaks in impure carbonates as correlation tools. They stated (Dixon *et al*., 1981, p. 303);

> '...the technique can be useful in delimiting intervals of time (cycle intervals) which correlate with similar intervals in other sections. To determine which of several cycles in one section correlates with a particular cycle in another requires demonstration of continuity or the use of independent age criteria'

Conodont information previously discussed has shown that shelf limestones of the uppermost Blue Fiord Formation in the Blue Fiord area are approximately synchronous (*serotinus* Zone) with shallow nearshore carbonates (Smith, 1984) of the Blue Fiord/Disappointment Bay Formation south of Schei syncline. In both areas there is evidence of regression following deposition of these lithologies. South of Schei syncline this regressive episode culminates in the deposition of member A unit 1 (sabkha evaporites and carbonate mudflats). North of Schei syncline the shallowest environments are represented by the stromatolitic silty dolomicrites (tidal mudflats) of member F unit 2. The tops of these two shallowest portions of the regression appear thus to be synchronous (there is no evidence of any loss of rock record through erosion at the culmination of the regression in the southern area); hence they are correlated in the cross sections (Text-fig. 7.2).

C. PALEOGEOGRAPHIC RECONSTRUCTIONS

Regional lithostratigraphic and event correlations in the Bird Fiord Formation have been used, in association with time lines indicated by biostratigraphic correlation, as the basis for reconstruction of the paleogeography of the eastern Arctic Islands from the late Emsian to the late Eifelian. This reconstruction is produced as a series of maps (Text-figs. 7.3 - 7.9), each representing a time-slice. The maps are assigned informal ages owing to the imprecise resolution of the conodont zonation. Where possible, approximate equivalent conodont zones are noted with the informal age assignment.

Early late Emsian: (late *serotinus* Zone) (Text-fig. 7.3) Shallow shelf to lagoonal impure limestones, siltstones and shales (top of the Blue Fiord Formation) in the Bird Fiord area are approximately equivalent to tidal flat carbonates assigned to the upper portion of the Blue Fiord/Disappointment Bay Formation south of the axis of Schei syncline. A shoreline is inferred on eastern Ellesmere Island, this being placed in this area on the basis of previous work (Smith, 1984). The southern trend of this shoreline is uncertain, but it may have swung westwards so that much of present day Devon Island was land. Tidal flat conditions prevailed over Grinnell Peninsula, Cornwallis Island and the eastern portion of Bathurst Island. A shelf edge was present on central Bathurst Island, the Blue Fiord/Disappointment Bay Formation carbonates pinching out into slope and basinal deposits of the Eids Formation (Uyeno and Mason, 1975 documented *serotinus* Zone conodonts from the Eids Formation at Twilight Creek). An isolated carbonate buildup was present in the vicinity of Cameron Island; this may be connected to a similar buildup in eastern Melville Island.

Late Emsian: (Text-fig. 7.4) This map shows the culmination of a regressive event begun in *serotinus* Zone time. While the facies types and distribution remain essentially unchanged on Bathurst and Cornwallis Islands, considerable changes occurred from Grinnell Peninsula to southern Ellesmere Island.

North of Schei syncline in the Bird Fiord area, the continuation of the regression was marked by the shallow shelf to lagoonal deposits of member F unit 1. The culmination of the regression was marked by the tidal flat facies of member F unit 2. The top of member F unit 2 is equivalent to the top of the sabkha facies south of the synclinal axis (member A unit 1). Grinnell Peninsula may have partly been land at this time, though some evaporitic deposition was in progress (see Morrow and Kerr, 1977; Map 1421A unit Du3). Confidence in the landmass positioned over Grinnell Peninsula is low. A disconformity is suspected in this area owing to the extreme restriction of the southwest Ellesmere area (member A unit 1), and to the abrupt base of the Bird Fiord equivalent carbonate unit present on Grinnell Peninsula. More fieldwork is needed in this area to clarify the geologic history.

Late Emsian/earliest Eifelian: (Text-fig. 7.5) A transgressive pulse changed facies distributions considerably. The shoreline had receded south from Grinnell Peninsula, and facies present on Ellesmere Island reflect marine encroachment.

Eastern Grinnell Peninsula, North Kent Island and southwest Ellesmere Island from Hell Gate to just west of

Grise Fiord was the site of non-evaporitic carbonate tidal flat to lagoonal deposition. A more clastic influence was present in the Grise Fiord region where mixed clastic-carbonate tidal flat facies were present. A shoreline nearby to the east is inferred. In the Bird Fiord area the transgression resulted in lagoonal environments (member F unit 3).

Western Grinnell Peninsula, Cornwallis Island and eastern Bathurst Island was the site of a shallow carbonate shelf (as represented by the top of the Blue Fiord/Disappointment Bay Formation and/or the Bird Fiord Formation carbonate equivalent). A shelf-slope break existed in central Bathurst Island, the shallow shelf carbonates interdigitating with siltstones assignable to the Eids Formation. The isolated carbonate buildup was still active in the Cameron Island and eastern Melville Island areas.

Late early Eifelian: (*costatus costatus* zone) (Text-fig. 7.6) Continuation of the transgression resulted in changes in facies distribution. The inferred easterly shoreline on Ellesmere Island was pushed back eastwards in the Grise Fiord area, but appears to have remained relatively stationary in the Baumann Fiord area. Its position is inferred by the presence of marginal marine redbeds assigned to the Strathcona Fiord Formation.

Southwest Ellesmere Island, both north and south of Schei syncline, was the site of shallow shelf to lagoonal environments (member B in the south and member F unit 4 in the north).

Grinnell Peninsula and eastern Bathurst Island were the site of a shallow open carbonate shelf (represented by the upper portion of the Bird Fiord carbonate equivalent). In north-central Bathurst Island this shallow shelf graded westward through deep shelf carbonates into slope and basinal deposits of the Eids Formation. In mid-central Bathurst Island, deep water carbonates were not present at this time. This may have been due to a shelf-slope reentrant in this area, or to a southerly pinchout of the deep water carbonate facies. Isolated biohermal buildups were present in the shelf slope transition of this area (as at 80SS13). The Cameron Island and eastern Melville Island carbonates were still accumulating at this time.

Subsequent paleogeographic reconstructions for the eastern part of the study area become less reliable due to an absence of relative ages for the strata, and to ignorance of the detailed stratigraphic relationships between the Strathcona Fiord Formation and the Hecla Bay Formation. Trettin (1978) distinguished five members (A to E) in the Strathcona Fiord Formation of west-central Ellesmere Island. He interpreted the environments of deposition of these members as: A- shallow subtidal to high intertidal mudflats: B- transitional delta fringe or delta front (terminal parts of river channels, sub-aqueous levées, mouthbars, and distal bars); C- delta plain; D and E- alluvial plain or delta plain. He described the Hecla Bay Formation as constituting the coarsest uppermost unit within a coarsening upward succession. This was taken to indicate that in this area the Hecla Bay Formation represents non-marine deposition of braided stream origin. Embry and Klovan (1976) discussed the distribution, environments of deposition and stratigraphic relationships between the Strathcona Fiord Formation and the Hecla Bay Formation. They interpreted the Strathcona Fiord Formation as having been deposited in tidal flat to delta plain environments. The Hecla Bay Formation was recognised to contain deposits of deltaic-marine origin (coarsening-upward cycles of shale → siltstone → sandstone, and of braided stream origin (scoured sandstone intervals within fining-upward cycles of sandstone → shale/siltstone and occasional coals.

Previous workers who had examined the Hecla Bay Formation in different parts of the arctic archipelago, had interpreted the formation differently. Tozer and Thorsteinsson (1964) stated that the formation on eastern Melville Island is almost certainly a non-marine deposit, and noted a change from homogenous white coloured sandstones in the eastern part of the island to alternating units of thick bedded, light coloured sandstone (Hecla Bay lithology) with thinly interbedded grey sandstone and shale (Weatherall lithology). Temple (1965) and Kerr (1974), working on Bathurst Island, suggested that the lower part of the Hecla Bay Formation is of beach origin whereas the upper part is aeolian. McGill (1973, 1974) interpreted the Hecla Bay Formation (termed the sandstone member of the Okse bay Group) in the Vendom Fiord area, Ellesmere Island, to be a continental, fluvial deposit. Roblesky (1979) concurred with this interpretation.

Embry and Klovan (1976) depicted the Hecla Bay Formation as being consistently younger than the Strathcona Fiord Formation (their figures 37, 38). They envisaged the deltaic-marine facies of the Bird Fiord Formation as facies equivalents of the 'meandering stream' facies of the Strathcona Fiord Formation, and considered that the 'braided stream' deposits of the Hecla Bay Formation on Ellesmere Island resulted from a change in paleoclimate, rather than representing a more proximal facies equivalent to the Strathcona Fiord Formation. Trettin (1978) hinted at the possibility that the Strathcona Fiord Formation and Hecla Bay Formation are partial time equivalents (Trettin, 1978, p.84) by interpreting the Givetian paleogeography of west-central Ellesmere Island as consisting of coastal plain and delta plain environments succeeded by meandering stream and braided fluvial facies as evidenced by the Strathcona Fiord and Hecla Bay formations. Roblesky (1979) agreed with Trettin (1978) in interpreting an encroachment through time of more source-proximal deposits.

Further fieldwork is needed to determine the relationship between these formations in west-central Ellesmere Island. A detailed sedimentological study is now in progress (Rice, in prep). The remaining paleogeographic maps (Text-figs. 7.7-7.9) consider the Hecla Bay Formation in the eastern Arctic to be a partial lateral equivalent of the Strathcona Fiord Formation.

Text-figures 7.7-7.9 - for the early to late middle Eifelian time interval - show a general advance of deltaic and fluvial clastics towards the west from easterly sources. This is accompanied by a coincident westward shift of shelf environments.

Early middle Eifelian: The previously carbonate dominated depositional style of the Bird Fiord Formation was altered to one of clastic domination by the initiation of deltaic sedimentation. The location of the sources of clastic supply is hampered by the deltas themselves not being preserved, and also by a lack of current direction data from the Bird Fiord Formation for this interval.

Member C, which was deposited on southwest Ellesmere Island during this time, represents shallow sandy shelf environments proximal to deltaic sources. Member C south of Schei syncline appears to be equivalent to shales and siltstones in the Bird Fiord area (member F unit 5) interpreted as "prodelta" deposits. This facies distribution infers the presence of more than one clastic source. The delta associated with member F unit 5 in the Bird Fiord area appears to have been in the Vendom Fiord region. A clue to the origin of the clastic sediments south of Schei syncline lies in the fact that the layercake stratigraphy characteristic of the Bird Fiord Formation in the North Kent Island to Muskox Fiord areas breaks up in the region of Baad Fiord. The formation in the Grise Fiord area, although poorly outcropping, appears to be largely composed of cross-bedded sandstones tentatively interpreted as shallow marine to shoreline in origin. This evidence indicates a southeasterly source for these clastics.

Age-equivalent rocks on Grinnell Peninsula and Bathurst Island (member C unit 1) represent distal shelf environments. Material supplied to the shelf in the region of Grise Fiord are envisaged to have been moved along and across the shelf towards the shelf break on Bathurst Island. Slope and basinal deposits east of this shelf edge, in the vicinity of Cameron Island and western Bathurst Island, are assigned to the Cape De Bray Formation.

Cessation of carbonate production in the Cameron Island and eastern Melville Island areas accompanied the initial influx of Bird Fiord Formation clastics. Age equivalent clastics capping the isolated carbonate buildups are assigned to the Cape De Bray Formation (Embry, 1976; Embry and Klovan, 1976).

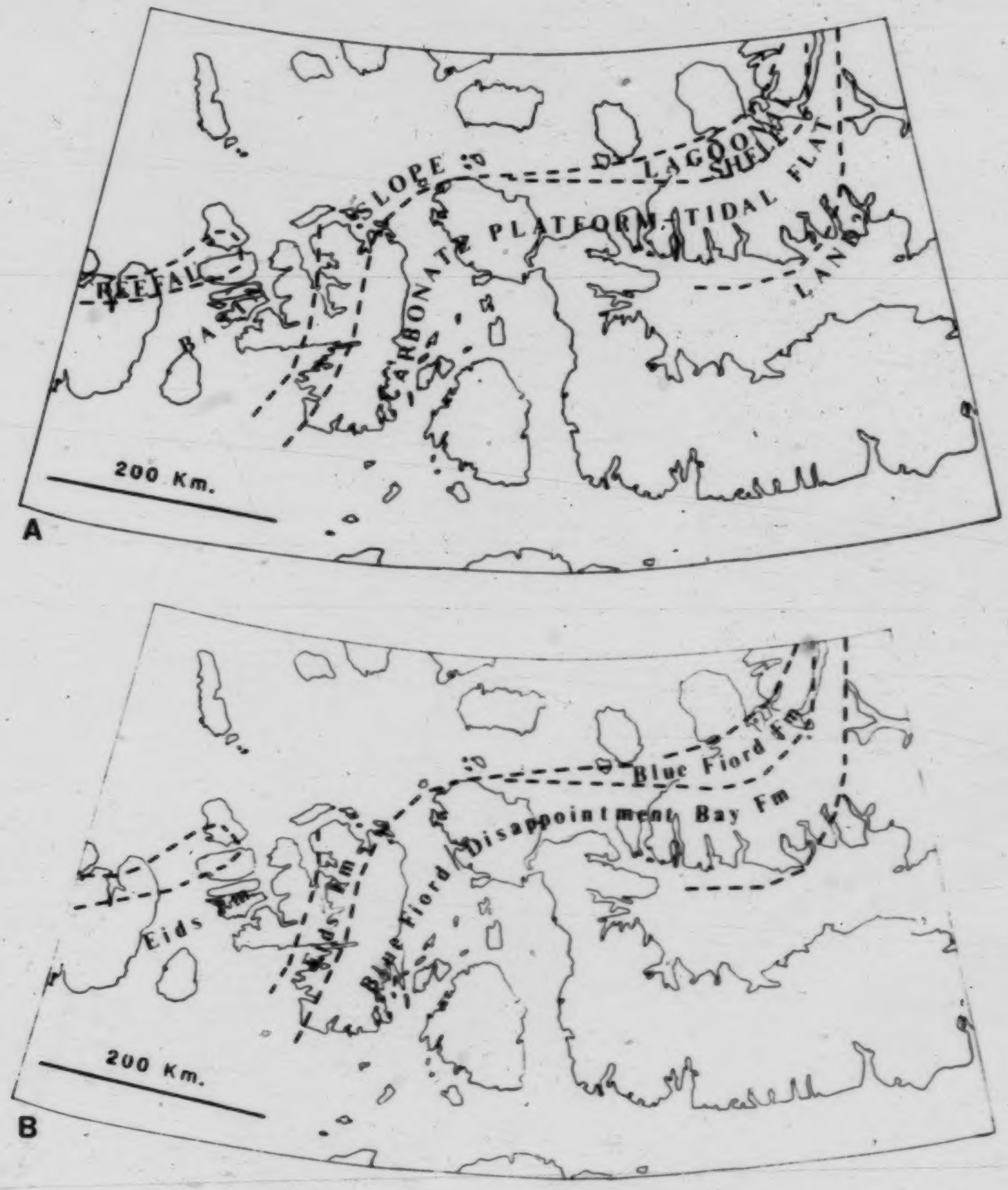
Middle Eifelian: (Text-fig. 7.8) Deltaic deposits had encroached over the southeastern portion of the study area. The remainder of Ellesmere Island, North Kent Island and northwest Devon Island was the site of deltaic shelf to shoreline environments (member D of the Bird Fiord Formation; ?member D of the Strathcona Fiord Formation of

Roblesky (1979, section 4, p. 106). A southerly clastic source is indicated for member D of the Bird Fiord Formation south of Schei syncline by northwestward and northeastward current directions preserved in mouthbar and delta-front sandstones, and from the northward pinchout of sheet sandstones observed in cliff exposures of member D on North Kent Island (Plates 25 and 26). Roblesky (1979) reported southwesterly directed current orientations from the Strathcona Fiord Formation in the area of Vendom Fiord.

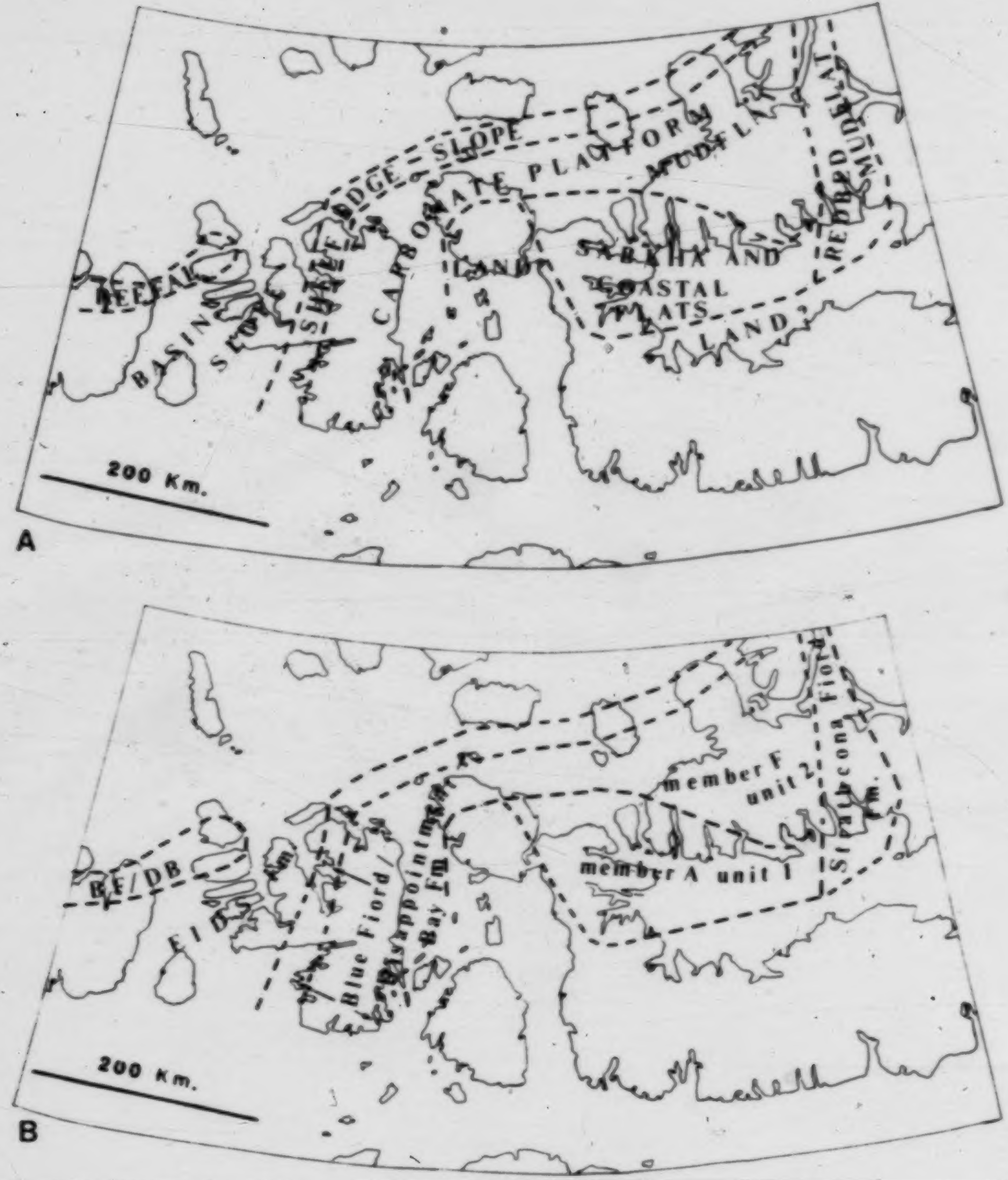
Proximal shelf conditions (Bird Fiord Formation member C unit 2) had advanced over Grinnell Peninsula and eastern Bathurst Island, with distal shelf deposition (Bird Fiord Formation member C unit 1) occurring in central and western Bathurst Island. It is estimated that the shelf-slope break lay in the region of a line running from Cameron Island to Byam Martin Island.

Late middle Eifelian: (Text-fig. 7.9) A new phase of deltaic sedimentation appears to have commenced by this time. The Strathcona Fiord Formation which overlies Members D and E of the Bird Fiord Formation heralds the westward advance of an Hecla Bay Formation deltaic sandstone. This portion of the Strathcona Fiord Formation (not studied by the author) appears to represent tidal flat/estuarine/lower delta plain environments which fringed the advancing fluvial Hecla Bay Formation. This deltaic pulse shifted the time equivalent shelf facies of the Bird Fiord Formation farther west.

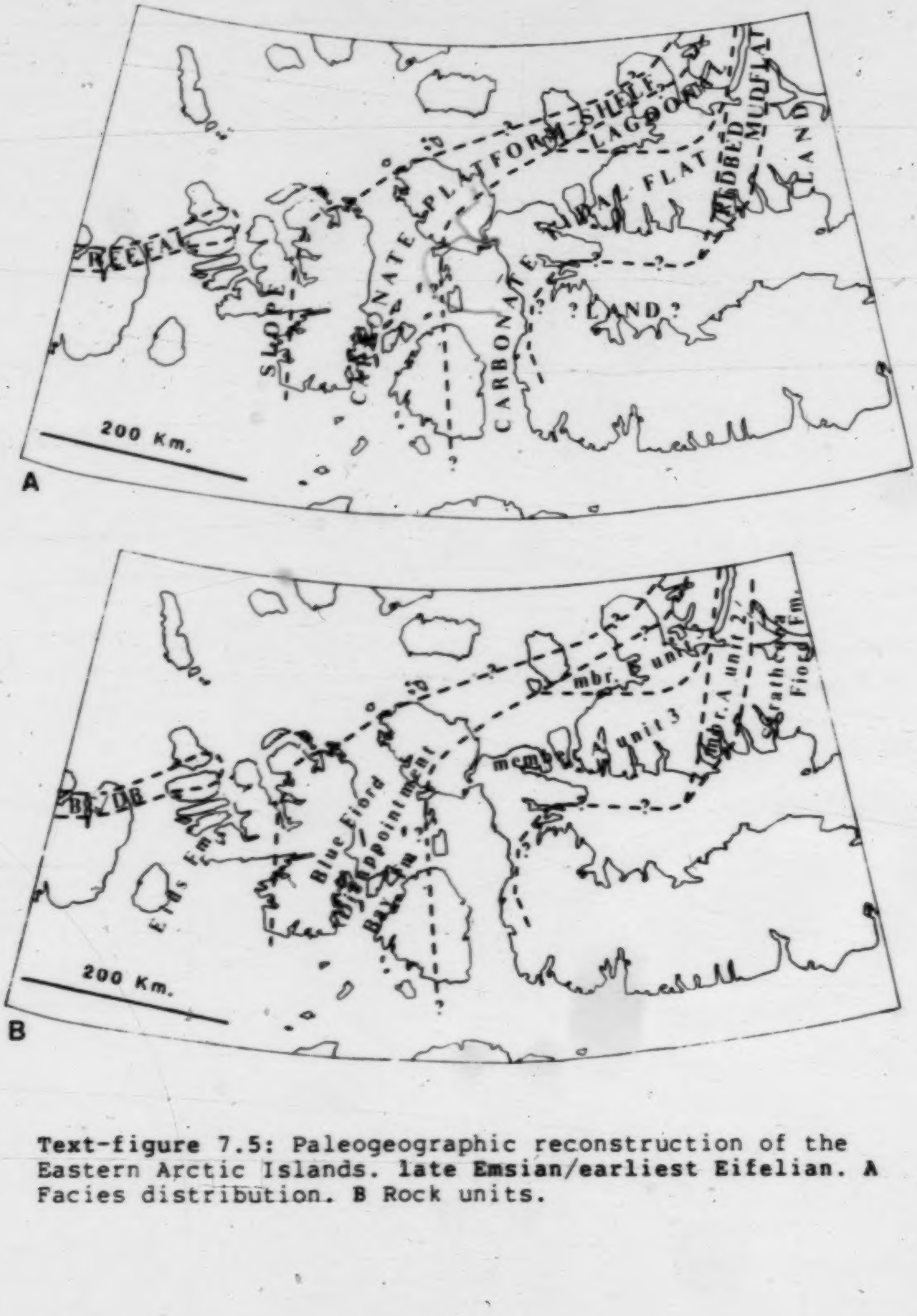
Insufficient information on the Strathcona Fiord and Hecla Bay formations negates the construction of paleogeographic maps up to the time of cessation of deposition of the Bird Fiord Formation in the Bathurst Island area. However, sparse evidence indicates a second deltaic advance within the Hecla Bay Formation which unconformably overstepped the Strathcona Fiord Formation in the Grinnell Peninsula region. Age equivalent Bird Fiord Formation proximal shelf and delta margin facies were deposited on Bathurst Island (member D units 1 and 2). Some of the information needed to verify or discount this second deltaic advance within the Hecla Bay Formation will be supplied by Rice (*in prep.*).


REEF
BASIN
SLOPE
LAGOON
SHELF
CARBONATE PLATFORM
TIDAL FLAT
LAND
200 Km.
A
Blue Fiord Fm
Disappointment Bay Fm
Eids Fm
Eids Fm
Blue Fiord Fm
200 Km.
B

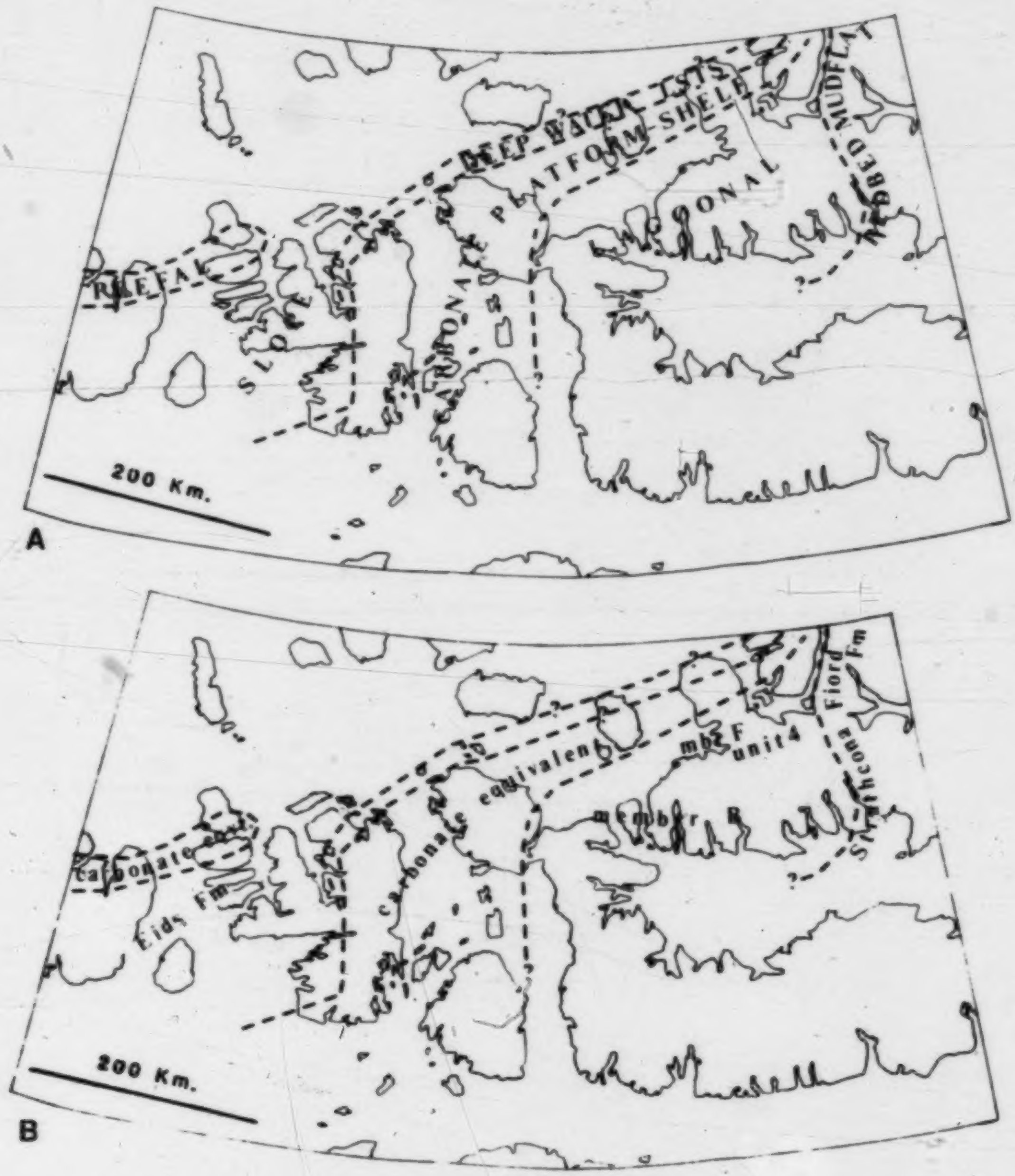
Text-figure 7.3: Paleogeographic reconstruction of the Eastern Arctic Islands. early late Emsian (late *serotinus* Zone). A Facies distribution. B Rock units.


REEFAL
BASIN
SLOPE
SHELF EDGE
SLOPE
CARBONATE PLATFORM
LAND
MUDFLAT
SABKHA AND
COASTAL
FLATS
LAND
RED BED
MUDFLAT
200 Km.
A
RF/DB
EID
Blue Fiord/
Disappointment Bay Fm.
member F
unit 2
member A unit 1
Strathcona Fiord Fm.
200 Km.
B

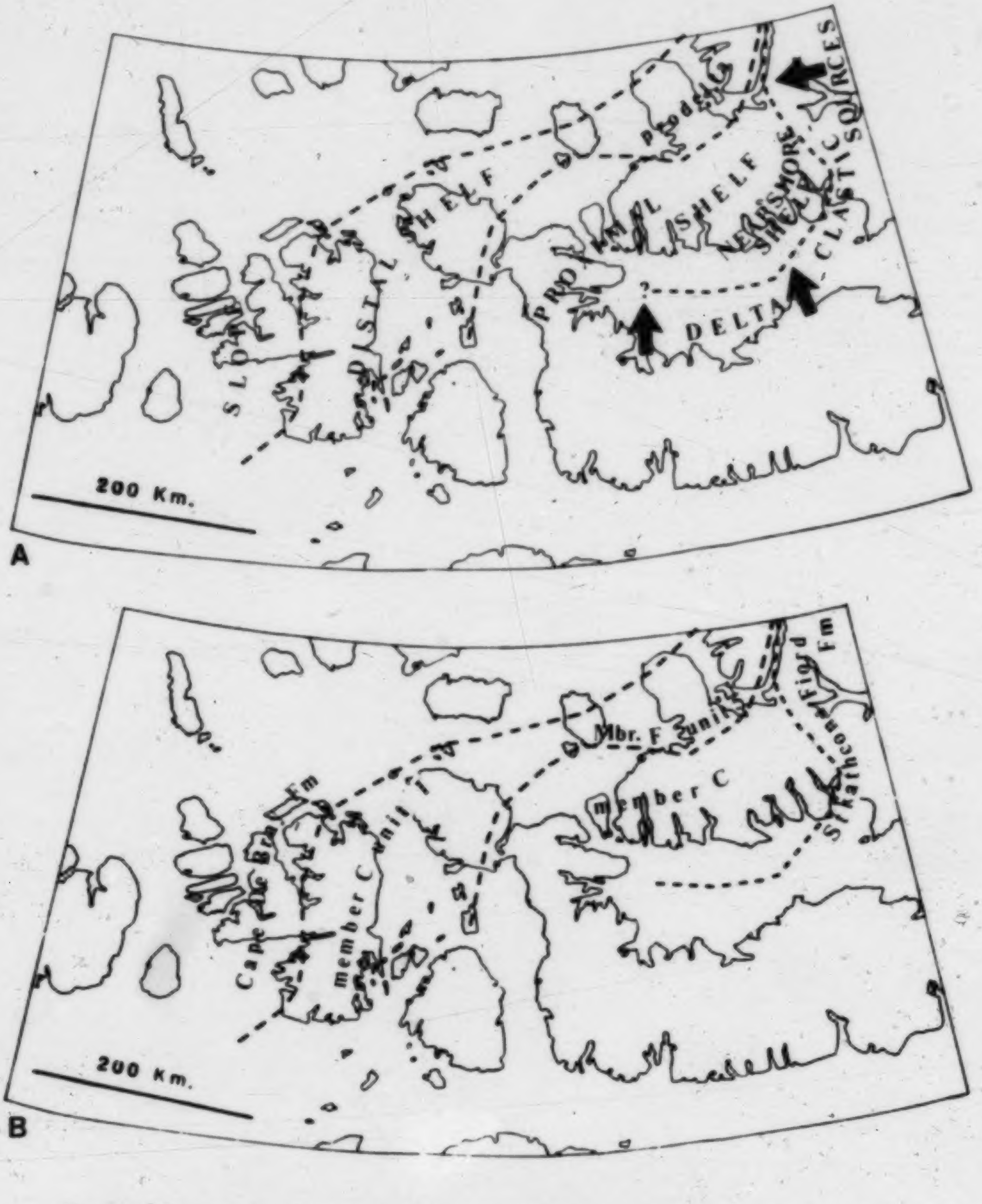
Text-figure 7.4: Paleogeographic reconstruction of the Eastern Arctic Islands. late Emsian. A Facies distribution. B Rock units.


REEF
SLOPE
CARBONATE
PLATFORM-SHELF
LAGOON ?
TIDAL FLAT
REDBED
MUDFLAT
LAND
? LAND ?
CARBONATE
200 Km.
A
BR
DB
Eids Fm
Blue Fiord
Disappointment Bay Fm
mbr. E unit
member A unit 3
mbr. A unit 2
Strathcona Fiord Fm.
200 Km.
B

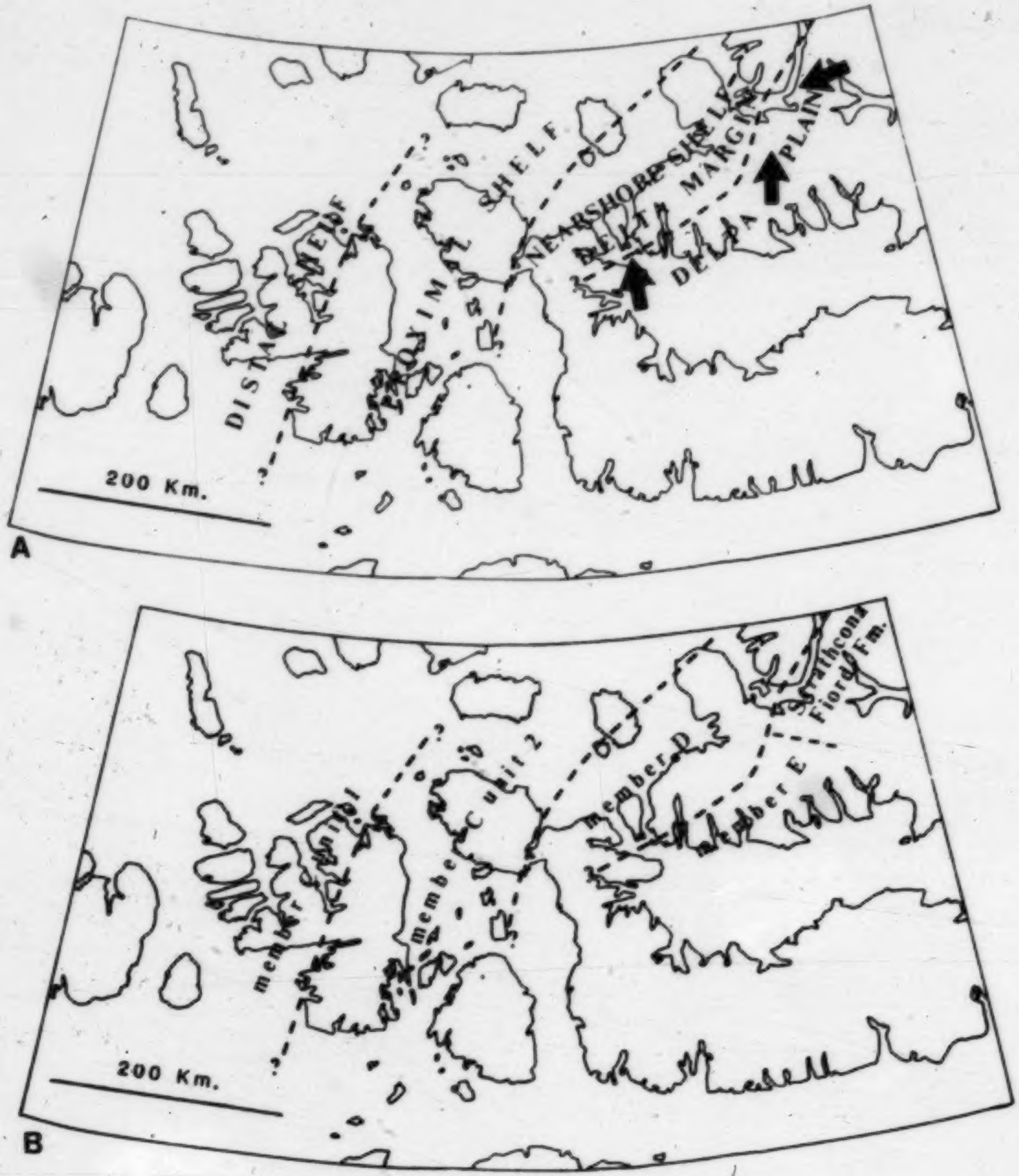
Text-figure 7.5: Paleogeographic reconstruction of the Eastern Arctic Islands. late Emsian/earliest Eifelian. A Facies distribution. B Rock units.


DEEP WATER SILTS
PLATFORM SHELF
REDBED MUDFLAT
REEFAL
SLOPE
CARBONATE PLATFORM
LAGOONAL
200 Km.
A
carbonate equivalent
mbr F
unit 4
Strathcona Fiord Fm
carbonate equivalent
member B
Eids Fm
200 Km.
B

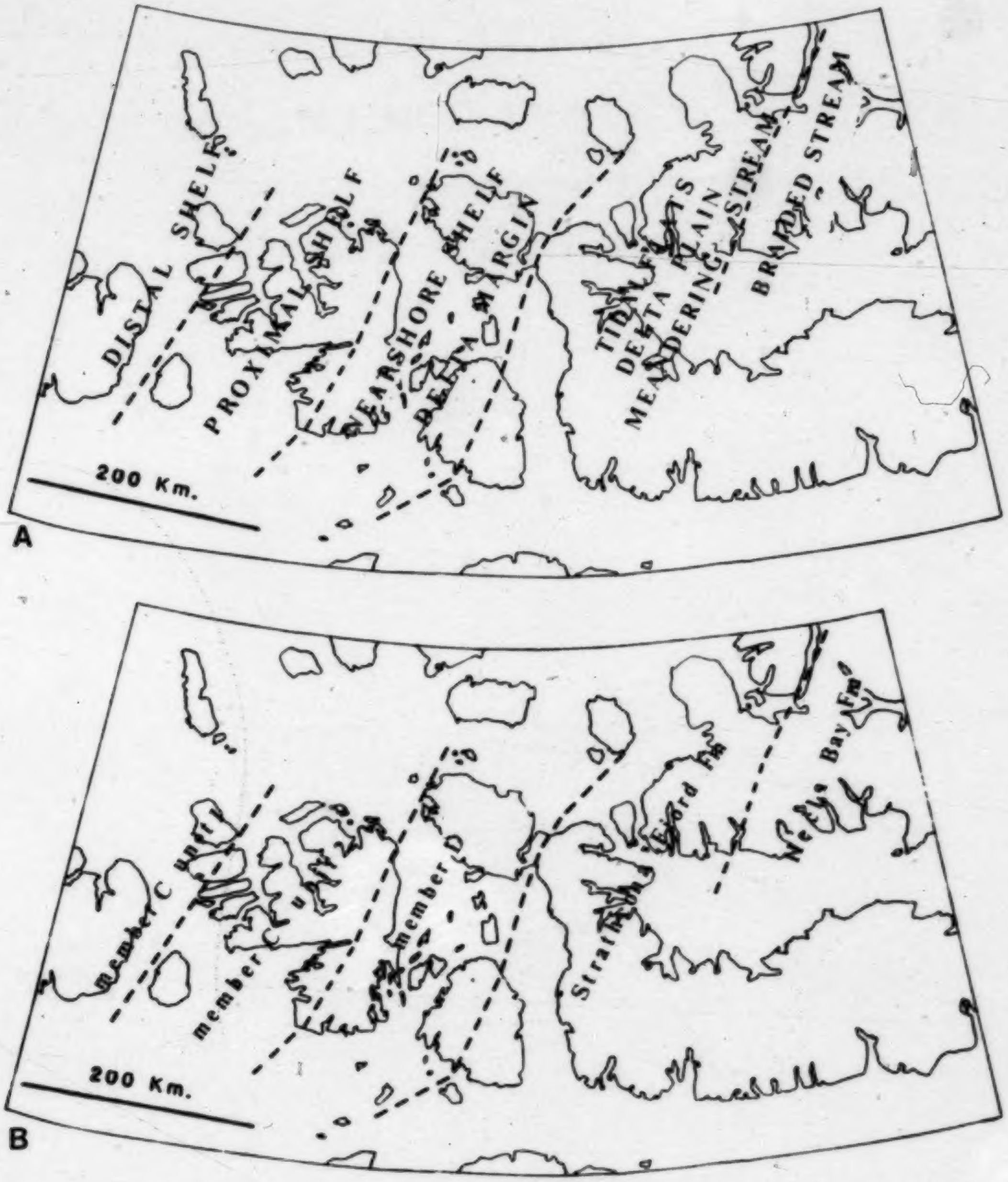
Text-figure 7.6: Paleogeographic reconstruction of the Eastern Arctic Islands. late early Eifelian (*costatus costatus* Zone). A Facies distribution. B Rock units.


SLOPE
DISTAL SHELF
PROXIMAL SHELF
Prodelta
NEARSHORE SHELF
DELTA
CLASTIC SOURCES
?
200 Km.
A
Cape de Bray Fm
member C
unit 1
Mbr. F unit
member C
Strathcona Fiord Fm
200 Km.
B

Text-figure 7.7: Paleogeographic reconstruction of the Eastern Arctic Islands. **early middle Eifelian. A Facies** distribution. B Rock units.


DISTAL SHELF
PROXIMAL SHELF
NEARSHORE SHELF
DELTA MARGIN
DELTA PLAIN
200 Km.
A
member
unit 1
member C
unit 2
member D
member E
Strathcona Fiord Fm.
200 Km.
B

Text-figure 7.8: Paleogeographic reconstruction of the Eastern Arctic Islands. **middle Eifelian. A** Facies distribution. **B** Rock units. Arrows indicate current directions from clastic sources.


DISTAL SHELF
PROXIMAL SHELF
NEARSHORE SHELF
DELTA MARGIN
TIDAL FLATS
DELTA PLAIN
MEANDERING STREAM
BRAIDED STREAM
200 Km.
A
member C unit 1
member C unit 2
member D
Strathcona Fiord Fm
Hecla Bay Fm
200 Km.
B

Text-figure 7.9: Paleogeographic reconstruction of the Eastern Arctic Islands. late middle Eifelian. A Facies distribution. B Rock units.

VIII. MEGAFAUNA OF THE BIRD FIORD FORMATION

Introduction

Members B and C of the Bird Fiord Formation are copiously fossiliferous. The faunas are commonly weathered out and hence easily collectable. In addition to the stratigraphic and sedimentologic aspects of this study, it was decided to collect this fauna so that a comprehensive knowledge of the taxonomic diversity in the formation would be known, and to enable detailed study of the paleoecology of the formation.

A. BRACHIOPODA

Prior to this study the brachiopod fauna of the Bird Fiord Formation was scantily known. McLaren (1963, p. 595) considered the fauna to be regionally homogenous and useful for correlation. Isolated collections were taxonomically described (Meyer, 1913; Johnson and Perry, 1976; Brice, 1982; Jones, 1982; Jones and Boucot, 1983), but beyond this no work on the regional distribution of the brachiopods in the Bird Fiord Formation has been done. Brice (1982) described brachiopod collections from the Blue Fiord and Bird Fiord formations across the Arctic Archipelago. She estimated (Brice 1982, p. 23) the age of the Bird Fiord Formation in the Bird Fiord area to be Upper Eifelian (based on the presence of *Elythyna*), and elsewhere to be Upper Eifelian to Givetian in age (based on the presence *Hypothyridina*, *Ivdelinia*, and *Cupularostrum*). Detailed age determination using brachiopods is hampered by the largely indigenous nature of the Arctic Island Devonian faunas. Brice, working mainly with collections made by other workers, made no attempt to study the distribution of the taxa in the Bird Fiord Formation, or to study factors limiting the distribution of the taxa. Raasch (1982) erected a zonation scheme for the Lower and Middle Devonian of the Canadian Arctic Archipelago utilizing brachiopods, and the Lower to Middle Devonian trilobite zonation established by Ormiston (1967). Raasch adhered solely to trilobites for megafossil zonation of the Middle Devonian rocks in the Arctic Islands because

> '...to date, except for the brachiopod faunas of the DM3 Zone* only the trilobites have received adequate taxonomic presentation.'

* Described by Johnson and Perry (1976)

The abundance of loose brachiopods in weathered outcrops of the Bird Fiord Formation prompted the author to systematically collect shelly faunas (strongly dominated by brachiopods) with the following aims:

1: To determine the complete taxonomic diversity of the Bird Fiord Formation brachiopod faunas.

2: To determine if the Bird Fiord Formation brachiopod faunas are regionally homogenous as according to McLaren, 1963.

3: To test the dependance of the brachiopod faunas on the paleoenvironments in which they occurred.

4: To test for the presence of recurring brachiopod associations, and;

5: To determine if a reliable zonation scheme based on brachiopods could be set up for the Bird Fiord Formation, and if so, to expand upon Raasch's (1982) Middle Devonian megafossil zonation scheme.

Methods:

Brachiopod faunas were systematically collected wherever weathered out faunas occurred in measured sections, or were encountered in foot and helicopter traverses. In excess of 48,000 specimens were collected from 140 separate localities throughout the outcrop belt of the Bird Fiord Formation (a complete listing of localities, and taxa abundances is presented in Appendix 4). Collection biases are considered to have been reduced to a minimum by maintaining a large sample size.

Results:

The Bird Fiord Formation brachiopod fauna comprises 26 taxa (Table 8.1). Except where positive identification is possible due to previous publication on the brachiopods, identification beyond the genus level is informal pending detailed taxonomic work (Jones and Goodbody *in prep.*).

It is immediately apparent that the brachiopods show marked patterns of distribution both stratigraphically and geographically (Text-figs. 8.1, 8.2, and 8.3 -in rear fold). Of the 26 taxa recognized (Pls. 37-39), 4 (*Anatrypa (V.) arctica*, *Atrypa* sp., *Cupularostrum repetitor* and *Spinatrypa*

TAXON	RAW COUNT	% OF TOTAL
ANATRYPA ARCTICA	8573	17.8
ATRYPA SP.	7879	16.4
COSTACRANAENA MARLENAE	643	1.3
CUPULAROSTRUM REPETITOR	9102	18.9
CUPULAROSTRUM? SP. A	417	0.9
ELYTHYNA SVERDRUPI	2546	5.3
EMANUELLA? SP.	1263	2.6
EOSCHUCHERTELLA? SP.	13	0.0
BIFIDA SP.	390	0.8
IVDELINIA GRINNELLENSIS?	263	0.5
LINGULA SP.	1	0.0
MEGASTROPHIA FRAMI	14	0.0
NUCLEOSPIRA SP.	778	1.6
PERRYSPIRIFER SCHEII	650	1.4
PHRAGMOSTROPHIA LATIOR?	374	0.8
PROTATHYRIS? SP.	110	0.2
'RHYNCHONELLID' SP.	13	0.0
SCHIZOPHORIA SULCATA	3521	7.3
SPINULICOSTA? SP.	1401	2.9
SPINATRYPA BOREALIS	8235	17.1
WARRENELLA SP.	1636	3.4
'STROPHOMENID' SP. 81A 224	118	0.2
'STROPHOMENID' SP. 81A 224B	45	0.1
'STROPHOMENID' SP. SEC V	5	0.0
'STROPHOMENID' SP. 81H 183	52	0.1
'STROPHOMENID' INDET.	9	0.0

Table 8.1: Percentage composition, by taxon, of brachiopods (N=48051) collected from throughout the distribution of the Bird Fiord Formation.

borealis) comprise 70.2% of the total specimen count, the remaining 22 taxa comprising 29.8% of the total fauna.

Two distinct faunal regions are discernible based on dominant taxa. The Grinnell Peninsula and Bathurst Island faunas are dominated by *Anatrypa (V.) arctica*, *Cupularostrum repetitor*, and *Spinatrypa borealis*; the Ellesmere Island faunas are overwhelmingly dominated by *Atrypa* sp. and *Elythyna sverdrupi*.

Text-figures 8.1, 8.2 and 8.3 also indicate a strong relationship between taxon distribution and the distribution of stratigraphic units in the Bird Fiord Formation. This may be interpreted as recording environmental preferences for the taxa. The most obvious cases of taxon dependence on paleoenvironment are:

1. The faunal change from member B to member C on Ellesmere Island.
2. The change in faunas from the Bird Fiord Formation carbonate equivalent to member C unit 1 on Grinnell Peninsula and Bathurst Island.

Elythyna sverdrupi is exceedingly common in rocks of member B on Ellesmere Island and northwest Devon Island. This brachiopod is rare on Grinnell Peninsula and absent on Bathurst Island. This geographical distribution agrees closely with the distribution of member B. Stratigraphically, *Elythyna sverdrupi* is closely limited to member B. This brachiopod is replaced by *Atrypa* sp. on the member B/member C boundary.

Brachiopods characteristic of the carbonate dominated sedimentary environments indicated by the Bird Fiord Formation carbonate equivalent include *Warrenella* sp. and *Anatrypa (V.) arctica*. Both these taxa are reduced in abundance or disappear with upsection changes in lithology (see Bathurst Island sections 80X and 80XII in Text-fig. 8.1 for the most obvious examples of this relationship). *Anatrypa (V.) arctica* appears to be a facies breaker on Grinnell Peninsula as it crosses over the boundary between the Bird Fiord Formation carbonate equivalent and the clastic Bird Fiord Formation; however *A. (V.) arctica* occurs only in strongly calcareous lithologies in member C unit 1 in this area.

The information obtained during the course of this fieldwork lends itself to examination of recurring associations of brachiopod taxa and the study of brachiopod communities. This work requires the use of advanced statistics and complex computer programs. This work is in progress as joint research between the author and Dr. B. Jones (U. of Alberta).

Even without statistical data manipulations however, it is apparent that

1: There is regional inhomogeneity in the distribution of the brachiopod faunas in the Bird Fiord Formation.

2: This inhomogeneity is relatable to regional variations in stratigraphy (hence paleoenvironment) within the Bird Fiord

Formation.

3: That brachiopods appear to be of little use as detailed correlation tools in the Middle Devonian of the Canadian Arctic Islands. This is a result of a strong relationship between the type of brachiopod fauna and the sedimentary environment in which they lived.

B. CORALS

Systematic collection of the coral faunas in the Bird Fiord Formation was conducted whenever material was encountered. The richest coral faunas in the Bird Fiord Formation were found in the uppermost unit in member B and the lower portion of member C in the Goose Fiord and Muskox Fiord region of Ellesmere Island. There both solitary and colonial corals occur in biostromes associated with variably impure limestones and calcareous sandstones. Corals are also common in member F unit 1 at Bird Fiord. A rich fauna predominantly of rugose corals was collected from the Bird Fiord Formation carbonate equivalent south of Young Inlet, Bathurst Island and in section 80X. A tabulate coral dominated fauna was collected from a small bioherm in this unit just south of Half Moon Bay, Bathurst Island (80SS 13).

Coral material was forwarded to Dr. A.E.H. Pedder (G.S.C. Calgary) for identification and age assignment. In addition to genera and species described by Loewe (1913), several new taxa were described (Pedder, 1982; Pedder and Goodbody, 1983). Unfortunately the corals found are endemic and of little use in age determination.

A complete listing of samples with identifications is presented in Appendix 3.

C. SPONGES

Conical calcareous sponges, approximately 5 centimeters maximum diameter, were found in coral dominated biostromes in member C and within bioclastic calcareous sandstones near the top of member B (Pl. 14 fig. 7) on southwest Ellesmere Island. Dr. K. Rigby (Brigham Young University) identified the material as heteractinid sponges closely related to *Stellarispongia* sp. described from the Blue Fiord Formation of Ellesmere Island (Rigby, 1976). Formal taxonomic description is in progress (Rigby and Goodbody *in prep.*)

IX. THE BIRD FIORD FORMATION: AN OVERVIEW

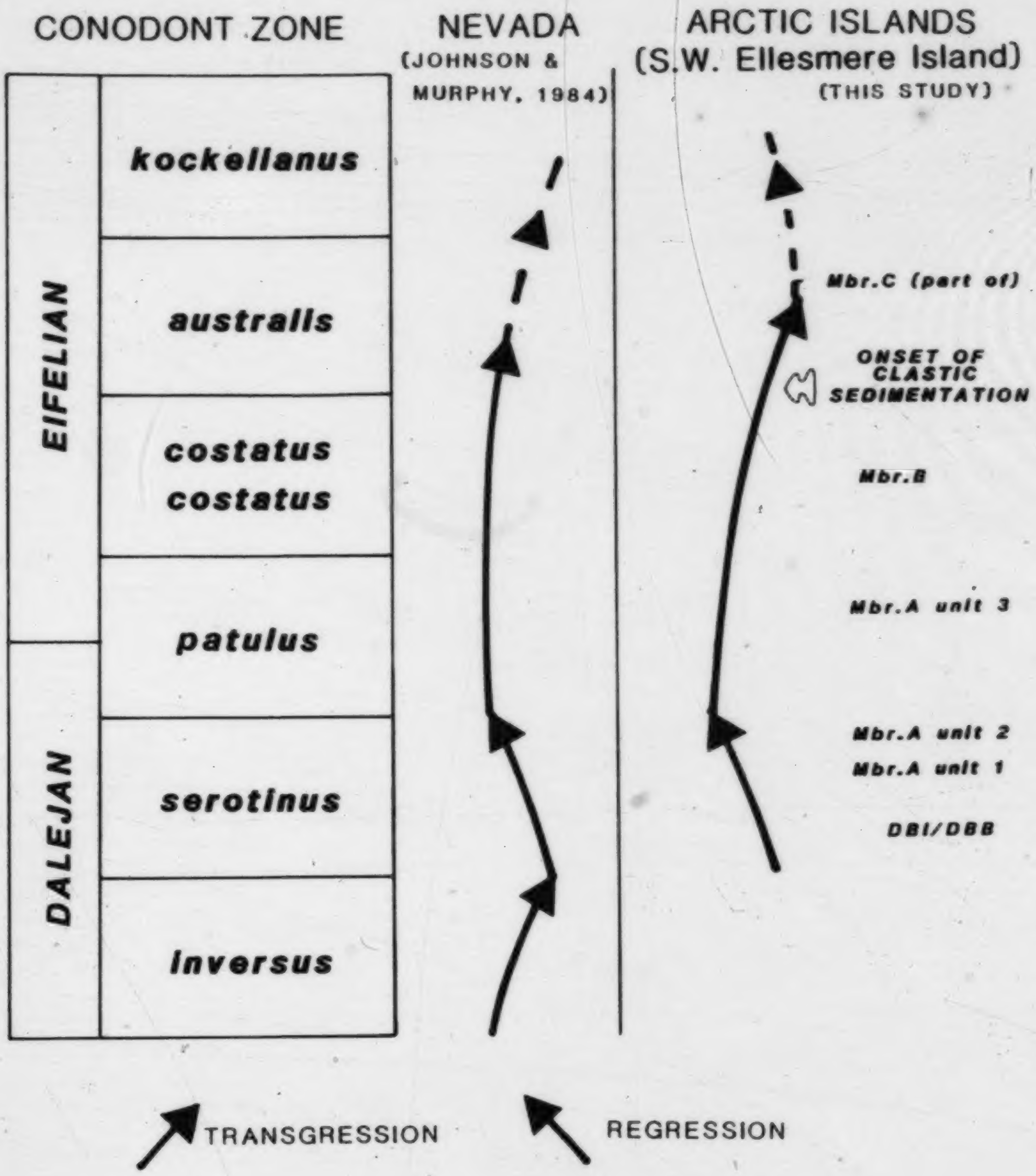
A. SEA LEVELS, CYCLICITY AND STRATIGRAPHY

Johnson (1971) considered that the coincidence of sea-level fluctuations in arctic, western, and eastern North America during the Devonian and Mississippian was due to the effects of the Antler Orogeny (sensu Johnson, 1971). He emphasised the correspondence of the onset of orogenic events with the onlap of a craton, and termed this effect the 'Antler Effect'. According to Johnson (1971) the onset of the Antler effect for the Antler Orogeny in North America is recorded by the beginning of deposition of the Kaskaskian sequence (Sloss, 1963). In the Arctic Islands the base of the Kaskaskian sequence lies at the base of the Lower Devonian Disappointment Bay Formation (Johnson, 1971).

Johnson (1971) divided the Antler orogeny into three successive depophases (during which the craton was transgressed and sedimentation took place) interspersed with three successive tectophases (during which orogenic episodes occurred). In the Arctic Islands the first depophase - initiated by the beginning of the Antler Orogeny - resulted in the deposition of the Disappointment Bay Formation, Blue Fiord Formation, and the lower carbonate part of the Bird Fiord Formation. The increase in clastics upsection in the Bird Fiord Formation, and the subsequent swamping of the Franklinian geosyncline by a large clastic wedge, masked subsequent phases of the Antler Orogeny in this region. The final phase of the Antler Orogeny, tectophase 3 (the Ellesmerian orogeny) resulted in the uplift, folding and erosion of the clastic wedge.

In the reference area of southwest Ellesmere Island the Bird Fiord Formation reflects a transgression (members A to B) followed by a regression (members C, D and E). This sea-level fluctuation can be compared to fluctuations discerned in rocks of the same age in Nevada (Johnson and Murphy, 1984). Relative deepening and shallowing was synchronous in the Arctic Islands and the western United States during the late early and early middle Devonian (Text-fig. 9.1). The base of the Bird Fiord Formation on southwest Ellesmere Island is in Transgressive/Regressive Cycle 2 of Johnson and Murphy (1984). The shallowest part, or 'height of regression' of this cycle is represented on southwest Ellesmere Island by member A unit 1 south of Schei syncline, and by member F unit 2 north of the synclinal axis. Member A unit 3 records a gradual transgression which culminated in member B. This transgression occurred at the same time as a transgressive pulse in Nevada which extended from the *patulus* Zone to at or near the base of the *australis* and *kockelianus* Zones (Johnson and Murphy, 1984).

Member C of the Bird Fiord Formation (dated as ?*kockelianus* Zone) marks the beginning of a further regression. This regression was due to the onset of clastic sedimentation which swamped the Franklinian geosyncline and locally masked Johnson's (1971) further tecto- and


CONODONT ZONE
NEVADA
(JOHNSON & MURPHY, 1984)
ARCTIC ISLANDS
(S.W. Ellesmere Island)
(THIS STUDY)
EIFELIAN
DALEJAN
kockelianus
australis
costatus costatus
patulus
serotinus
inversus
Mbr.C (part of)
ONSET OF CLASTIC SEDIMENTATION
Mbr.B
Mbr.A unit 3
Mbr.A unit 2
Mbr.A unit 1
DBI/DBB
TRANSGRESSION
REGRESSION

Text-figure 9.1: Comparison of Transgressive/Regressive cycles in Nevada and Arctic Canada. Lower to Middle Devonian.

depo-phases of the Antler Orogeny. The synchroneity of transgression and regression in Nevada and the Arctic Islands necessitates an allocyclic explanation. During the Early Devonian the northern hemisphere was in a state of maximum regression, followed by transgression during the Middle Devonian. At the same time the Malvinokaffric Province of the southern hemisphere was undergoing regression following a time of maximum onlap. This prompted Johnson (1971) to conclude that a combination of eustatic and epeirogenic causes were responsible for the sea-level change. Valentine and Moores (1970) and Watts (1982) explained sea-level fluctuations using plate tectonic theory. Sloss (1979) and Bally (1981) suggested that the effects of global sea-level changes are subordinate to tectonics, and the major control on stratigraphic sequences are widespread and correlatable tectonic events associated with major plate reorganizations. Johnson's (1971) combined Antler Orogeny and Antler Effect concur with Bally's (1981) suggestion.

THE ORIGIN OF SMALL SCALE RHYTHMS

The Bird Fiord Formation exhibits considerable repetition of facies sequences within the larger scale transgression and regression cycles discussed above. These smaller scale cycles (or rhythms) warrant discussion in the framework of current ideas in the fields of stratigraphy and sedimentology.

As for biological evolutionary theory (Eldredge and Gould, 1972), the gradualistic approach in classical stratigraphy has recently been questioned (Anderson and Goodwin, 1980; Byers, 1982; Anderson, Goodwin and Sobieski, 1984; Busch and Rollins, 1984). Numerous examples of deposits exhibiting cyclic (rhythmic) patterns of facies sequences resulting from sedimentation in a wide variety of environments exist in the literature. Busch and Rollins (1984) used an hierarchy of cyclic sequences (transgressive units) for correlation in Carboniferous strata exhibiting a high degree of cyclicity. They recognised six scales of transgressive/regressive units (Table 9.1); the three highest of these are identical to the highest categories of Vail *et al*. (1977). Busch and Rollins (1984) divided the smaller cycles in their sequence into three levels, adopting the 'punctuated aggradational cycle' terminology and philosophy of Anderson and Goodwin (1980). Anderson and Goodwin (1980, 1982) and Anderson *et al*. (1984) considered accumulation of the cyclic Helderberg Group of New York State to have been episodic, rather than gradual. They based this conclusion on the presence of distinct, widespread, aggradational sequences 1-5 meters thick, each sequence or Punctuated Aggradational Cycle (PAC) representing gradual accumulation between punctuated, rapid rises in sea-level (Text-fig. 9.2).These authors argued that the formation boundaries in the Helderberg Group correspond to PAC boundaries. These boundaries are contacts between facies

RANK	***DURATION***	***ROCK RECORD APPELLATION***
1	200-300 Ma	
2	10-80 Ma	?SLOSS SEQUENCES
3	8-10 Ma	?TRANSGRESSIVE/REGRESSIVE CYCLES (JOHNSON & MURPHY 1984)
4	0.8-1.5 Ma	?MESOTHEMS (BUSCH & ROLLINS 1984)
5	400,000-450,000yr	CYCLOTHEMIC PAC SEQUENCES (ANDERSON & GOODWIN 1982)
6	100,000-225,000yr	PUNCTUATED AGGRADATIONAL CYCLES (ANDERSON & GOODWIN 1980)

Table 9.1: Hierarchy of Transgressive/Regressive cycles and nomenclature of corresponding rock sequences (modified from Busch and Rollins, 1984).

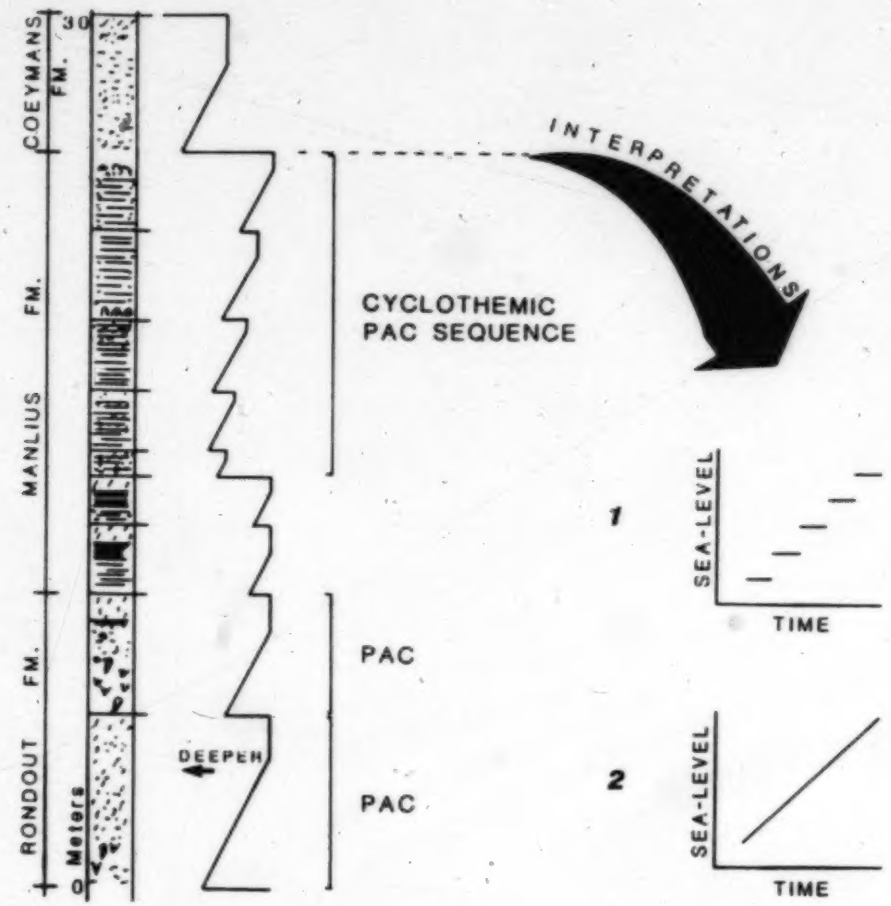
which cannot represent laterally adjacent depositional environments, and hence represent rapid rises in sea-level. They concluded that sea-level rises in rapid short bursts, and that the rapid changes in sea-level are separated by periods of relative stability during which sedimentation occurs. Anderson and Goodwin (1980) further stated that due to this mechanism, member boundaries represent locally an isochronous surface, and regionally a series of stepped isochronous surfaces (Text-fig. 9.2).

Anderson and Goodwin (1980) and Anderson *et al.* (1984) did not elaborate on possible causative mechanisms for a punctuated depositional history. Busch and Rollins (1984) stated that

> "...according to PAC hypothesis, most sedimentary sequences are composed of allocyclic transgressive/regressive units 1-5 meters thick which represent accumulation over a period of tens of thousands of years."

The 1-5 meter thick cycles (or rhythms) referred to in the above quote from Busch and Rollins (1984) are the sixth order cycles in Table 9.1.

The mechanisms producing such repetitive small scale relative changes in sea-level have been the subject of much discussion. Basically the arguments are two-fold. Anderson and Goodwin (1980) and adherents consider PACs to result from allocyclic processes. Others, such as Ginsburg (1971), Matti and McKee (1976) and Mossop (1979) consider the cycles to result from autocyclic processes. Allocyclic models consider that sea-level changes (either due to eustacy or

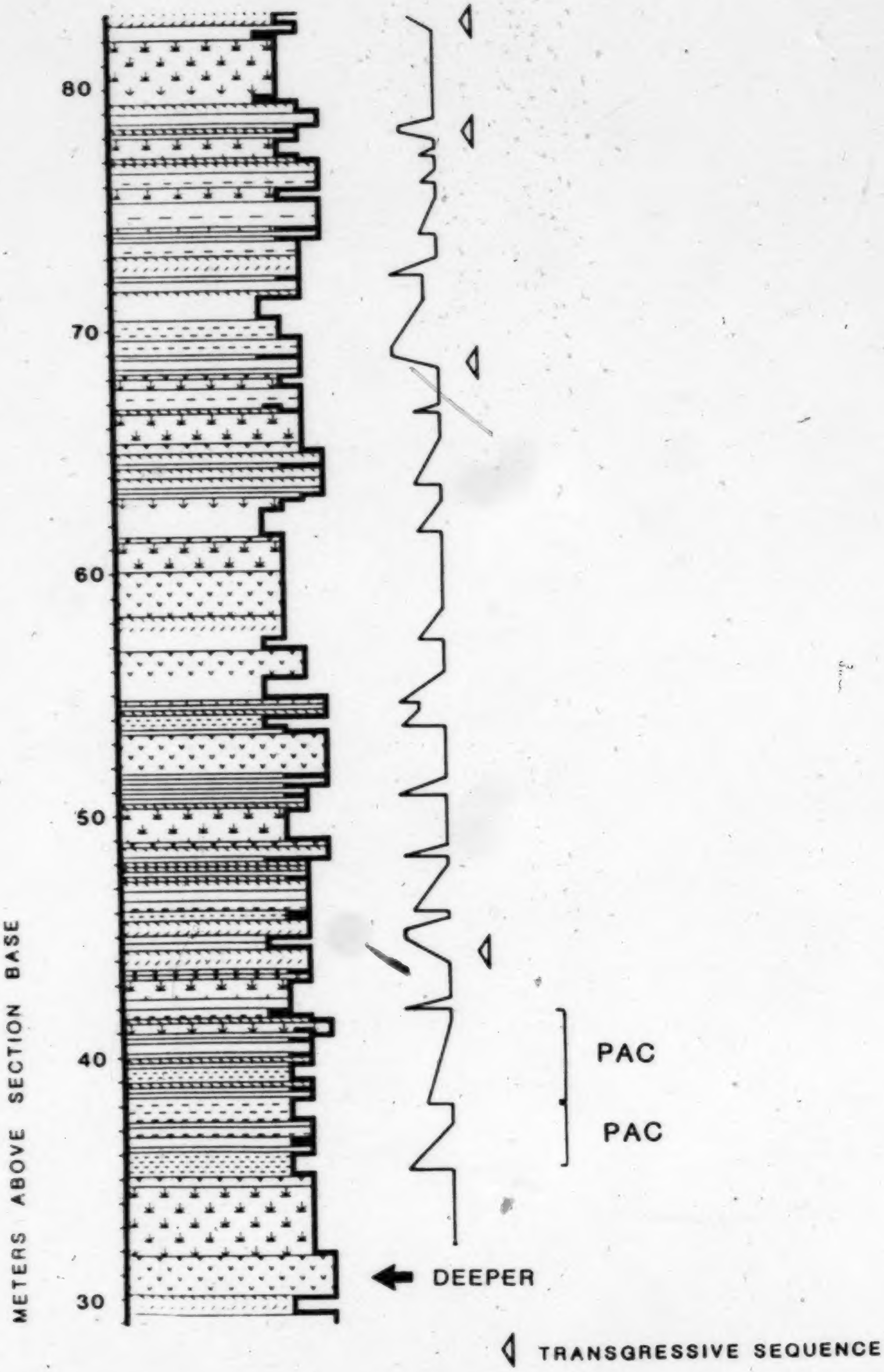

COEYMANS FM.
MANLIUS FM.
RONDOUT FM.
Meters
30
0
DEEPER
CYCLOTHEMIC PAC SEQUENCE
PAC
PAC
INTERPRETATIONS
1
SEA-LEVEL
TIME
2
SEA-LEVEL
TIME

Text-figure 9.2: Cyclicity in the Helderberg Group (from Anderson *et al.*, 1984). Inset graph 1 shows punctuated sea-level rise as envisaged by Anderson and Goodwin (1980). Note stepped isochronous stratigraphic boundaries. Inset graph 2 shows classic concept of gradational sea-level rise with smoothly diachronous stratigraphic boundaries.

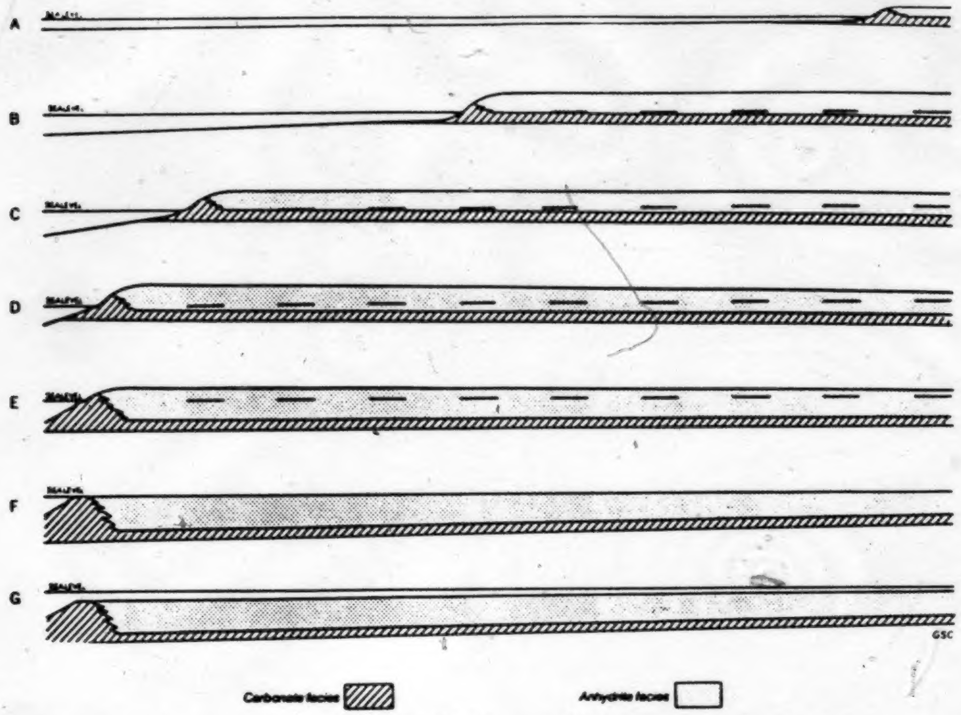
basin subsidence) associated with steady, relatively slow, rates of sedimentation, may give rise to repetitive facies sequences. Autocyclic models consider that variation in the rates of sedimentation and deposition may give rise to repetitive facies sequences.

Bott and Johnson (1966), working on cyclic sedimentation at the PAC scale in the Carboniferous in Great Britain, concluded that a tectonic, rather than a eustatic mechanism, was responsible for the production of stacked facies-sequence packages. Repeated crustal subsidence along faults at the basin margins was thought to be due to a sympathetic isostatic effect between a rising mountain range and a basin undergoing sediment loading, this happening through the mechanism of asthenosphere/upper mantle creep and brittle fracture in the lithosphere. Johnson (1971) envisaged viscous coupling between mantle convection cells and lithospheric plates as a possible mechanism for the diastrophic control theory for the origin of Pennsylvanian and Permian cyclothems in the eastern United States.

Autocyclic models have also been proposed to explain repetitive stratigraphy at the PAC scale (Ginsburg, 1971; Matti and McKee, 1976; Mossop, 1979; Wilkinson, 1982). Wilkinson (1982) and James (1984) discussed the models of various authors, explaining the development of individual PACs and of cyclothemic PAC sequences (Table 9.1), and the relationship between time and deposition in the stratigraphic record. All the above authors use carbonate shoaling-upward sequences as case studies for autocyclicity. This is due partly to the abundance of such regressive sequences in the rock record, to the autochthonous production of the sediment, and to the relative lack of complications resulting from differential compaction as compared with clastic regimes. Also, well documented recent analogues to ancient carbonate sequences are available. Mossop (1979) modelled the production of stacked carbonate-evaporite sequences in the Ordovician Baumann Fiord Formation on Ellesmere Island using autocyclic processes. Since this model is directly applicable to member A unit 1 rhythms it will be described in detail. Mossop (1979) modelled (Text-fig. 9.4) a stable platform that is either undergoing a constant subsidence rate, or a constant sea-level rise. The rate of subsidence in the seaward portion slightly exceeds that in the landward portion, with complete gradation between the two. Carbonate sedimentation is concentrated in the shoreline zone; lagoonal areas receive very little detritus, and supratidal areas well back from the shoreline receive very little washover sediment. Displacive anhydrite growth, which effects a measure of vertical jacking of the sabkha surface, is concentrated in the nearshore supratidal area and diminishes inland. The seaward extremity of the sabkha complex in the model may be marked by a barrier complex analagous to the Trucial Coast islands and shoals, or alternatively, the seaward extent of progradation may be limited by the capacity of the shoreline


METERS ABOVE SECTION BASE
30
40
50
60
70
80
DEEPER
PAC
PAC
TRANSGRESSIVE SEQUENCE

Text-figure 9.3: 30-80 meter portion of section 82C1 showing part of Member A unit 1 of the Bird Fiord Formation. Individual PACs are delineated. Note also the presence of several 'transgressive' facies-sequences.



Text-figure 9.4: Mossop's (1979) model for repetitious superimposition of sabkha cycles. The seaward part of the system is to the left, the landward part to the right.

A). Progradation begins. The shoreline advances over the shallow but continually deepening lagoon.

B). Progradation continues. The seaward parts of the lagoon continue to deepen. The supratidal anhydrite facies thickens in the zone immediately behind the shoreline, but at the landward extremity of the system stabilizes in thickness (now well removed from the locus of washover and brine supply) and begins to subside below the groundwater reference datum.

C). Progradation continues, somewhat slowed by the necessity of building into ever deeper water. Earliest formed parts of the anhydrite facies, now having reached thickness equilibrium, continue to subside below the sea-level datum.

D). Progradation essentially ceases, further significant advance precluded by deep water and continuing difficulty in keeping pace with constant subsidence (here somewhat more pronounced). stabilized landward portions of the anhydrite facies continue to subside.

E). Stagnation. Anhydrite growth continues in the nearshore supratidal zone but, because of anhydrite occlusion of porosity (restricting brine access), vertical jacking by displacive anhydrite growth is lessened and subsidence dominates.

F). Land level subsides to sea-level, with transgression imminent.

G). Transgression, establishing a shallow lagoon over the whole of the pre-existing sabkha flat, preluding a re-initiation of progradational advance.

sedimentation processes to build into ever deeper water. Seaward advance occurs through preferential sedimentation in the shoreline zone. The rate of sedimentation keeps pace with the rate of subsidence/sea-level rise until the shoreline has advanced into water of sufficient depth to slow progradation. Stagnation occurs which eventually ends with a transgression over the sabkha complex, and displacement of the shoreline back into an area of shallow water and low gradient so the cycle of events can begin again (Text-fig. 9.4).

Similar models for carbonate lagoonal-tidal flat sequences were proposed by Ginsburg (1971) and Matti and McKee (1976). The ideal cycle (rhythm) resulting from Mossop's model is very similar to the ideal rhythms recognised in member A unit 1 of the Bird Fiord Formation (Text-figs. 5.6, 5.7). Variations on the ideal rhythms, such as anomalously thick development of a particular facies, or incompleteness of the rhythms, are explained in Mossop's model as being due to slight variation in the relative rates of subsidence/sea-level rise and sedimentation. These variations are evident in the PACs of member A unit 1 (Text-fig. 9.3). It also should be noted that several transgressive sequences are present in member A unit 1 of the Bird Fiord Formation (Text-fig. 9.3). Although transgressive sequences are greatly outnumbered by regressive sequences (Text-fig. 9.3), their presence indicates rates of sea-level rise with which sedimentation could keep up. This is contrary to the ideas of Anderson *et al.* (1984) on punctuated rapid rises in sea-level, and casts doubt on the explanation of the PACs in member A of the Bird Fiord Formation as solely being due to punctuated sudden rises in sea-level. The 'cyclothemic PAC sequences' noted by Anderson *et al.* (1984) in the Helderberg Group (Text-fig. 9.2) cannot be recognised with certainty in the Bird Fiord Formation. No definite shallowing sequences of PACs are discernible in member A (Text-fig. 9.3).

Mossop (1979) was able to demonstrate, by having sections parallel and perpendicular to depositional strike, the widespread and persistent nature of his 'cycles' (PACs). He considered the Baumann Fiord Formation platform to be an homogenous structural block. Correlation across depositional strike in the Bird Fiord Formation is hampered by distance between sections, and by the presence of a structural hinge (parallelling the axis of the Schei syncline) between outcrop belts (i.e. between sections 82C1 and 81E/81F). Those sections along depositional strike (81H, 81G, 82C, 83A-A3, 82B-B2, 83B) are not correlatable at the PAC scale, nor at the cyclothemic PAC sequence scale. This, and notable thickness changes in member A unit 1 along depositional strike, suggest a more complicated platform than the simple one on which the Baumann Fiord Formation was deposited. No 'platform-wide' transgressive events, other than those already described on a member scale at the beginning of this chapter, are evident. Instead it appears that the Bird Fiord platform on southwest Ellesmere Island was composed of a number of semi-independent structural blocks, each with a separate sedimentological history on the PAC scale, and on the member scale when considering stratigraphic changes across Schei syncline.

The thickness and multiplicity of the rhythms (PACs or cycles) in both the regressive member A unit 1 (Text-fig. 9.3) and the transgressive member A unit 3 attest to a delicate balance between subsidence, rate of sea-level change, and sedimentation rate. If subsidence were to increase, a relative deepening with the concomitant production of thick(er) subtidal sequences would result. If subsidence decreased, the response would have been extensive subaerial exposure, diagenesis, and possibly erosion.

Significant clastic input was present north of Schei syncline and east of Baad Fiord while little or no clastic influence was occurring in the Goose Fiord region. This complicates application of the simple platform-wide autocyclic model of Mossop (1979) to the Bird Fiord Formation. With the addition of a clastic source, the shoreline zone can no longer be considered the sole sediment production area. Autocyclic processes with either a longshore drift accretion mechanism, a tidal fall-out mechanism, or a land-source progradational mechanism, must be considered for the formation of mixed carbonate/clastic aggradational sequences. It is unlikely that the rate of clastic sediment input in the near-source areas (Baad Fiord, Vendom Fiord and Bird Fiord) would have balanced exactly the rate of autochthonous carbonate production in the areas distal from the clastic sources (North Kent Island, Goose Fiord and Muskox Fiord). This variation in sediment input and accumulation between different areas on the platform was probably accompanied by local differential block faulting. This complicates correlation between strike-sections and hampers the recognition of 'platform-wide' events.

During deposition of member A the platform on southwest Ellesmere Island was probably dotted by a mosaic of exposed banks separated by subtidal and intertidal areas. The whole complex probably shifted both laterally and vertically through time in response to structural events (allocyclic processes) and autocyclic processes.

The base of member B marks a transgressive pulse: as such it is probably a time-line between Norlolk Inlet and Baad Fiord. This transgression cannot have been large since the advent of deposition in more open marine environments was accompanied by an influx of sand-sized clastic material. Any significant increase in sea-level would have drowned clastic sources and resulted in pure carbonate deposition.

Member B possesses a background 'tendency' for rhythmic facies sequences; these rhythms are rare relative to planar interbedding of prominent and semi-prominent rubbly bedded sandy limestones/calcareous sandstones (Plate 14 figs. 4, 5; Plate 15 figure 7; Plate 17). The relative scarcity of rhythms in this member is the result of erosion of the fine grained parts of the rhythms, with subsequent stacking of coarse grained beds. The general lack of rhythmicity at the PAC and cyclothemic PAC sequence level in this member was probably due to the complex interplay of carbonate production, variation in clastic supply, and an increasing relative importance of destructive shallow shelf processes in a 'static' sea-level situation (one in which sedimentation keeps pace with sea-level change).

Members C, D and E record the initial phase of a clastic influx which resulted in the filling of the basin. These members exhibit considerable rhyhmicity; however, this rhythmicity does not appear to owe its origin to sea-level change.

Member C contains different scales of rhythms in different geographic areas (from Bathurst Island to Ellesmere Island) and at different stratigraphic heights in the member. Changes in the scale of rhythms is due to differences in proximity to the source areas. This resulted in differences in the rate and continuity of supply of sand sized material. Variation in the importance of physical processes in different parts of the shelf may have had a significant effect. The larger scale rhythms of member C unit 1 on Grinnell Peninsula and Bathurst Island resulted from variation in sediment supply to the distal shelf. This variation in supply was due either to fluctuations in sea-level, or discontinuous tectonism in the source area(s), or to a combination of these factors.

The distance from the source area to the shelf "edge" was approximately 200 kilometers. Modelling sediment movement across a shelf of this size is reasonable in the light of Porter (1976) and Rice (1984) who modelled sand dispersal for distances of up to 1100 kilometers in the Mesozoic interior seaway of North America.

Member C on North Kent Island and southwest Ellesmere Island is characterized by repetitive rhythms that resulted from variation in source proximity and sedimentary (storm and fairweather) processes. Sea-level was probably relatively static (with respect to the rate of subsidence and sedimentation) during the deposition of the member in this area. Embry and Klovan (1976) considered similar rhythms in the Bird Fiord Formation on Bathurst Island as resulting from local relative sea-level fluctuation. According to their model, concentration of clastic input into an area would be accompanied by local regression and deltaic advance. The upper sand part of the deltaics would be transgressively reworked following delta switching and local relative sea-level rise. This mechanism is discounted for the small scale rhythms on Bathurst and Ellesmere Islands for the following reasons:

1). *In situ* subtidal faunas (coral and sponge biostromes, brachiopod coquinas) occur in the capping sandstones indicating that at no time were they subjected to subaerial exposure: and

2). The presence of obviously marine rhythms of similar style, but higher calcareous content, in member B shows that rhythms of such type can be produced in a marine setting without minor transgressions and regressions.

Rhythmicity is not readily apparent in the very nearshore and shoreface deposits (Text-fig. 9.8: parts of members C on Ellesmere Island, and parts on member D throughout this members distribution). This lack of rhythmicity is due to the amalgamation of storm sandstones through erosion of the fines in the lower parts of the 'rhythms'.

Member D, however, does record minor positive changes in sea-level which interrupt the overall regression. Delta margin sandstones are overlain by shallow shelf coarsening-up rhythms in sections on southwest Ellesmere Island. Reworked abandoned delta lobes are inferred in exposures on the west coast of North Kent Island (Plate 25 figure 7), and 'barrier' sandstones are intercalated with shallow shelf rhythms on central Bathurst Island (Plate 36 figures 1.2). Whether these sea-level variations were the result of regional sea-level rise, or due to local transgressions initiated by source abandonment (accompanied by a tipping of the scales of rates of sedimentation versus basin subsidence and sealevel rise in favour of the latter), or due to subsidence caused by compaction, is not known. Such 'transgressions' would have to be traced in the field to determine their extent and origin.

Member E rhythmicity is a product of repetitive fluvial channel cut-and-fill.

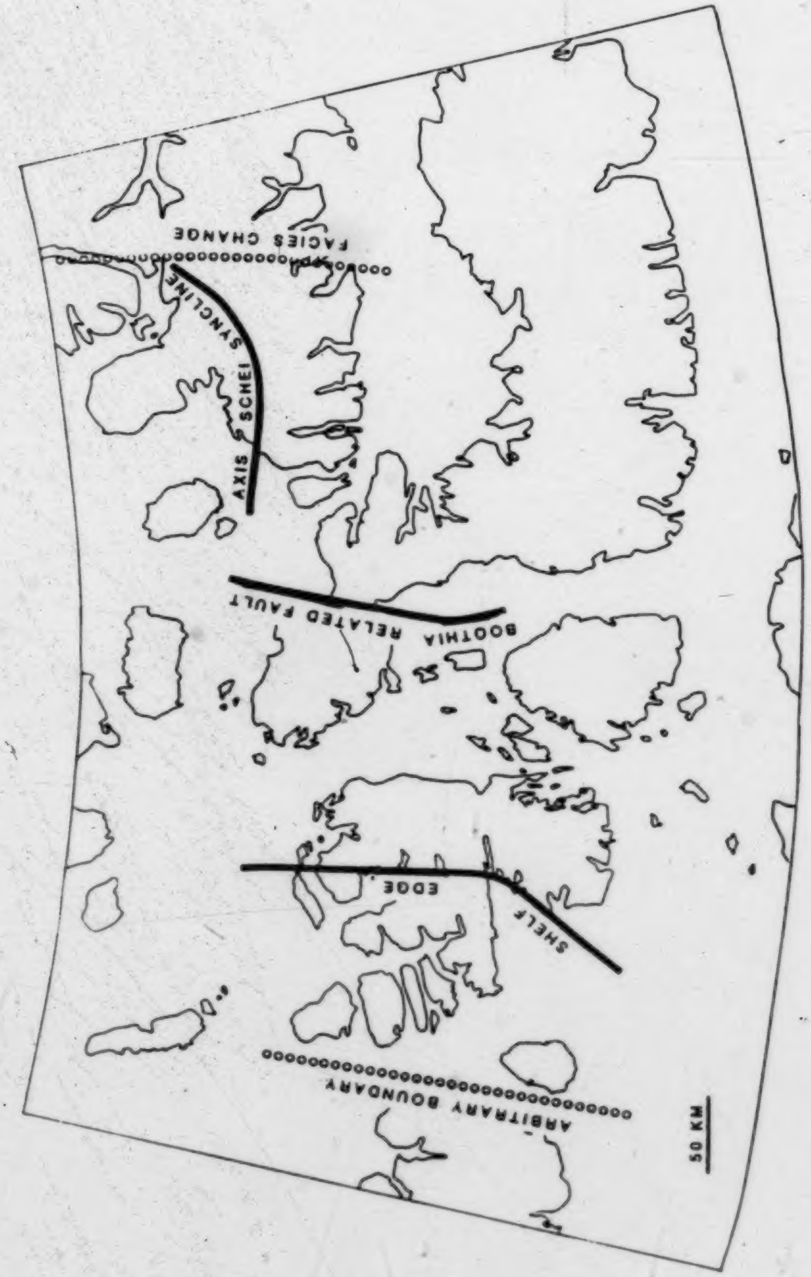
B. STRUCTURAL MAKE-UP OF THE BIRD FIORD FORMATION SHELF

Lateral variation, at the member scale, in the Bird Fiord Formation indicates that several structural features were active during deposition of the formation. To a certain extent these features governed the distribution of the sedimentary environments (Text-fig. 9.5).

To the east and southeast of the study area horst and graben faulting (Smith and Roblesky, 1984) provided sources for clastic sediments. Uplifted blocks of the Canadian Shield to the south also acted as a sediment source. On southwest Ellesmere Island the Bird Fiord Formation 'shelf' was made up of two parts; a southern platform separated from a northern part by a syndepositional hinge along which northward downwarping occurred.

Important changes in the internal stratigraphy of the formation in the region of Arthur Fiord (Text-fig. 7.1) suggest an active structural feature which is herein termed a 'Boothia related fault' (Text-figure 9.5). This area is a zone of considerable structural complexity (see Morrow and Kerr, 1977, Map 1421A) that probably reflects deepseated basement structures which may have been reactivated throughout the Phanerozoic.

A relatively homogenous platform appears to have been present between Arthur Fiord and central Bathurst Island


FACIES CHANGE
AXIS SCHEI SYNCLINE
BOOTHIA RELATED FAULT
SHELF EDGE
ARBITRARY BOUNDARY
50 KM

Text-figure 9.5: Structural features affecting sedimentation: Bird Fiord Formation time

(Text-fig. 9.5), though it must be stated that coverage of this area is minimal. The westward pinchout of Lower Paleozoic carbonates in the region of central Bathurst Island (Text-fig. 10.1) attests to the longevity of a shelf edge in this region. This shelf edge affected deposition of the Bird Fiord Formation carbonate equivalent and member C unit 1 of the Bird Fiord Formation. Continual clastic influx in the lower Middle Devonian filled the basin to the west with deep water deposits assigned to the Cape De Bray Formation, and resulted in the burial of the shelf edge. More detailed stratigraphic work is needed in this area to determine whether this shelf edge became truly dormant, or if it affected sedimentation in the late Middle and Upper Devonian by means of syndepositional movement.

C. SOURCE AREA FOR CLASTICS

The provenance of the sediments of the Middle and Upper Devonian clastic wedge in the Arctic Islands has been discussed by Martin (1961), Tozer and Thorsteinsson (1964), Temple (1965), Grant and Prendergast (1971), Dineley (1975), Embry and Klovan (1976), Trettin (1978), Trettin and Balkwill (1979), Roblesky (1979), Smith and Stearn (1982) and Smith and Roblesky (1984). Martin (1961) proposed that the wedge of clastics extending from Ellesmere Island to Alaska and the Yukon was derived from a continuous orogenic belt along the margin of the Arctic Ocean. Tozer and Thorsteinsson (1964) considered the late Middle and early

Upper Devonian formations of the archipelago as similar to the clastic wedge deposits of the Appalachians which were derived from the east. They suggested that the arctic islands wedge was derived from an analagous belt of tectonic lands to the northwest. Tozer and Thorsteinsson (1964, p. 208) regarded the shield area (except for the Boothia arch) as

> '...low lying, partly covered with epicontinental seas...'

and thus

> '...ill-qualified to be the source of clastic wedge sediments.'

Temple (1965) questioned this interpretation due to the quartzose composition of Middle and Upper Devonian clastics on Bathurst Island. He postulated a landmass of sialic composition and of continental proportions as a source area. He did not elaborate on its position (Embry and Klovan, 1976). Grant and Prendergast (1971) suggested derivation of clastics mainly from southeasterly sources and to a lesser extent from northerly sources. Dineley (1975) suggested derivation from the Caledonian orogenic belt in Greenland. Embry and Klovan (1976) recognised a three-fold division of the Devonian clastic wedge (the Hecla Bay wedge; Beverley Inlet wedge; and Parry Islands wedge - in ascending order), and the possibility of changes in emphasis of source area for these subdivisions. They subdivided the Hecla Bay wedge into two 'time-stratigraphic intervals' to permit analysis of the source areas and changes of the source areas during the development of the wedge. On the basis of mineralogy, paleocurrent data, facies distribution in the 'time-stratigraphic interval', and regional geology of the arctic, they suggested that the source for the sediments of the Strathcona Fiord Formation/ Bird Fiord Formation/Cape De Bray Formation subdivision lay to the northeast of central Ellesmere Island (Embry and Klovan, 1976, fig. 48). Trettin (1978, p. 86) stated of the Strathcona Fiord Formation in west-central Ellesmere Island:

> 'Paleocurrent indicators southeast of Cañon Fiord are subparallel to strike in a southwestward direction'....'This suggests longitudinal transport in a roughly strike-parallel foreland basin that could have received sediments from the Pearya Geanticline to the northwest, the Caledonian orogenic belt to the northeast, and the Canadian Shield to the southeast; the relative importance of these three potential sources is difficult to assess at present.'

Trettin and Balkwill (1979) reiterated these statements. Roblesky (1979) showed a general westerly to southwesterly transport direction for sediments in the Strathcona Fiord Formation. He considered that the chert pebbles and fragments in the Strathcona Fiord Formation, interpreted by Trettin (1978) as indicative of a northerly Pearya Geanticline source, could have come from Greenland as well as northern Ellesmere and Axel Heiberg islands. Roblesky (1979) considered the Precambrian shield of Ellesmere Island and Greenland as the dominant source areas for the Strathcona Fiord Formation and its age equivalents, with the Caledonides of east Greenland as a possible less significant source. He did not rule out the Pearya Geanticline as a source, stating (Roblesky, 1979, p. 160):

> 'The Pearya Geanticline appears to have been an intermittent source of sediment to the Vendom Fiord region, but the positive influence of the Pearya Geanticline as a source probably increases in a northward direction from the study area [region of Vendom Fiord] towards the geanticline.'

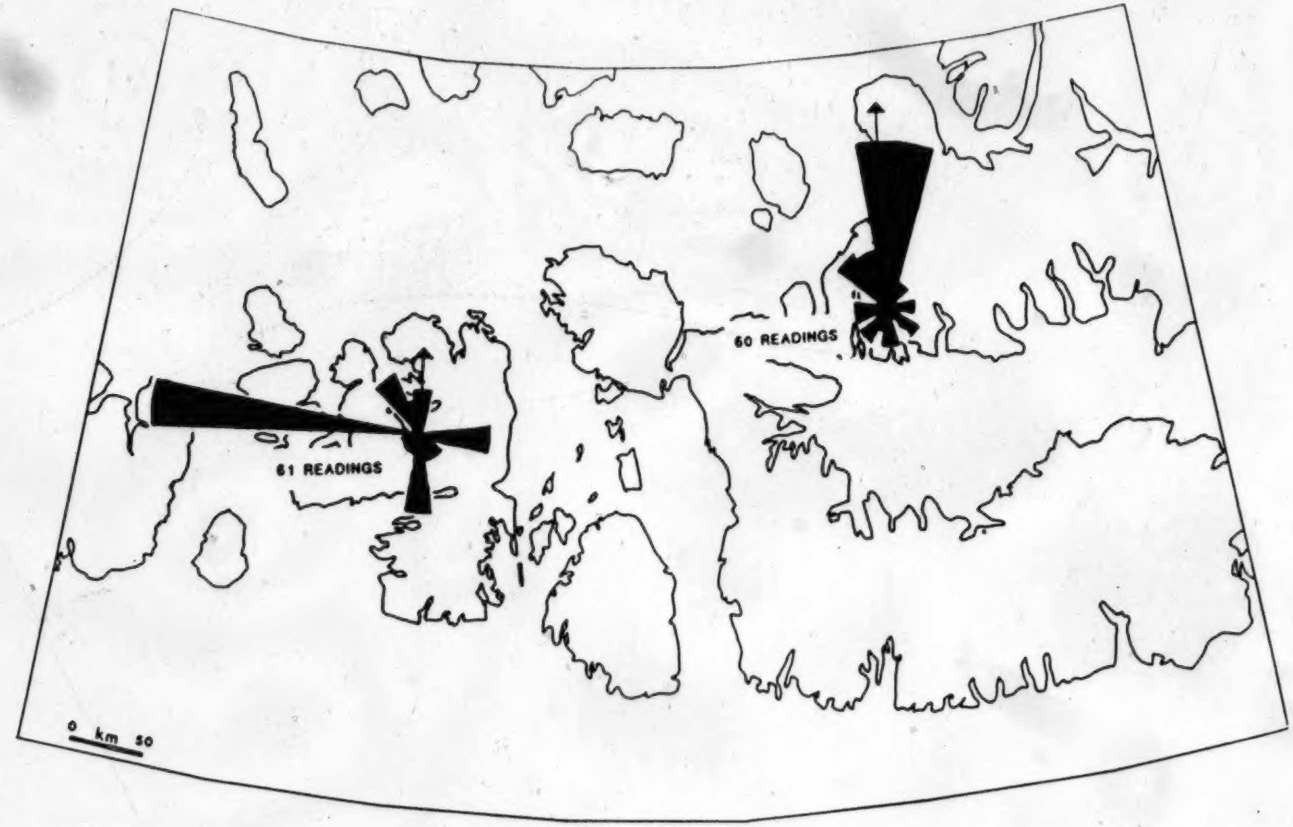
Smith and Stearn (1982) and Smith and Roblesky (1984) considered the Middle and Upper Devonian clastics on Ellesmere Island to have been derived from the 'Inglefield Uplift', a term they used for an uplifted block of shield on southeastern Ellesmere Island.

The present study provides evidence that clastics in the Bird Fiord Formation between Cardigan Strait and Grise Fiord were derived from southeasterly and southerly sources. This is indicated by:

1). The predominantly northerly (northeasterly and northwesterly) current indicators in members C, D and E on southwest Ellesmere Island (Text-fig. 9.6). The rose diagram positioned over southwest Ellesmere Island in Text-figure 9.6 is drawn from current direction readings taken from delta margin (proximal mouth bars) and fluvial (channel-fill) facies. As such it represents the directions of transport of material from the source area(s) into the basin.

2). The northerly pinchout of 'deltaic' sandstone units in the cliff on the east coast of North Kent Island (Plates 25, 26).

Age equivalent clastics between Bird Fiord and the Vendom Fiord region, assigned to the Bird Fiord and



Text-figure 9.6: Paleocurrent readings, Bird Fiord Formation. Rose diagram over S.E. Ellesmere Island based on readings from delta margin and fluvial facies - thus indicating sediment influx from a southerly source. Rose diagram over Bathurst Island based on readings from distal and proximal shelf facies - thus indicating direction of sediment dispersal on the Bird Fiord shelf.

Strathcona Fiord formations, have an easterly and northeasterly derivation.

The mineralogy of the rocks of the Bird Fiord Formation was not covered in this study, but will be the subject of further investigation. Preliminary study of thin sections supports Embry and Klovan's (1976) assessment that the sandstones in the Bird Fiord Formation are formed predominantly of detrital quartz, with subordinate feldspars and micas. This is indicative of a silica-rich source such as uplifted sialic basement or reworking of older sedimentary rocks with a quartz content.

Bird (1967) identified a series of erosion surfaces, or peneplains, extending from Baffin Island across the southern Arctic Islands. He tentatively concluded that the oldest of these denudation surfaces may be up to Precambrian in age, and that the series of surfaces represent many cycles of uplift and erosion. The sediments of the Bird Fiord Formation may have been derived from denudation in Bird's (1967) 'Eastern Rim' area (Text-fig. 9.7).

Current directions in contemporaneous Strathcona Fiord Formation rocks in the region of Vendom Fiord indicate another source area to the north and northeast of Vendom Fiord (Embry and Klovan, 1976; Trettin, 1978; Roblesky, 1979). It thus appears that there was more than one source area for clastics on southwest Ellesmere Island in the late Middle Devonian.

Reliable paleocurrent evidence is not available from the Bird Fiord Formation on Grinnell Peninsula. Readings from member C on central Bathurst Island show a predominantly westward transport of shelf sediment (Text-fig. 9.5). The rose diagram positioned over Bathurst Island in Text-figure 9.6 is drawn from current direction readings largely from proximal shelf facies. A few readings (those with northerly and southerly tendencies) were taken from delta margin facies. This rose diagram represents the directions of sediment distribution on the Bird Fiord Formation shelf. The sparse current directions from littoral/delta margin deposits in member D indicate a component of northerly and southerly flow. The stratigraphically lower appearance of thick sandstones in section 80XII compared to sections farther north up Dundee Bight may either indicate a southerly source for deltaics in the Bathurst Island area (possibly associated with a cycle of denudation within Bird's (1967) paleoerosion framework), or simply may be associated with an earlier arrival of a deltaic lobe of the generally westward moving wedge. Facies changes and paleocurrent measurements in the Hecla Bay Formation indicate derivation mainly from the east and northeast (Embry and Klovan, 1976). Considerably more fieldwork is needed on the Okse Bay Group of Bathurst Island to either confirm, or disprove, a southerly source for some of the clastics. The predominant source direction appears to have been to the east and northeast, possibly associated with Pearya mountain front (Text-figure 9.7).

D. THE BIRD FIORD FORMATION AS A MODEL FOR CLASTIC SHELF SEDIMENTATION

INTRODUCTION

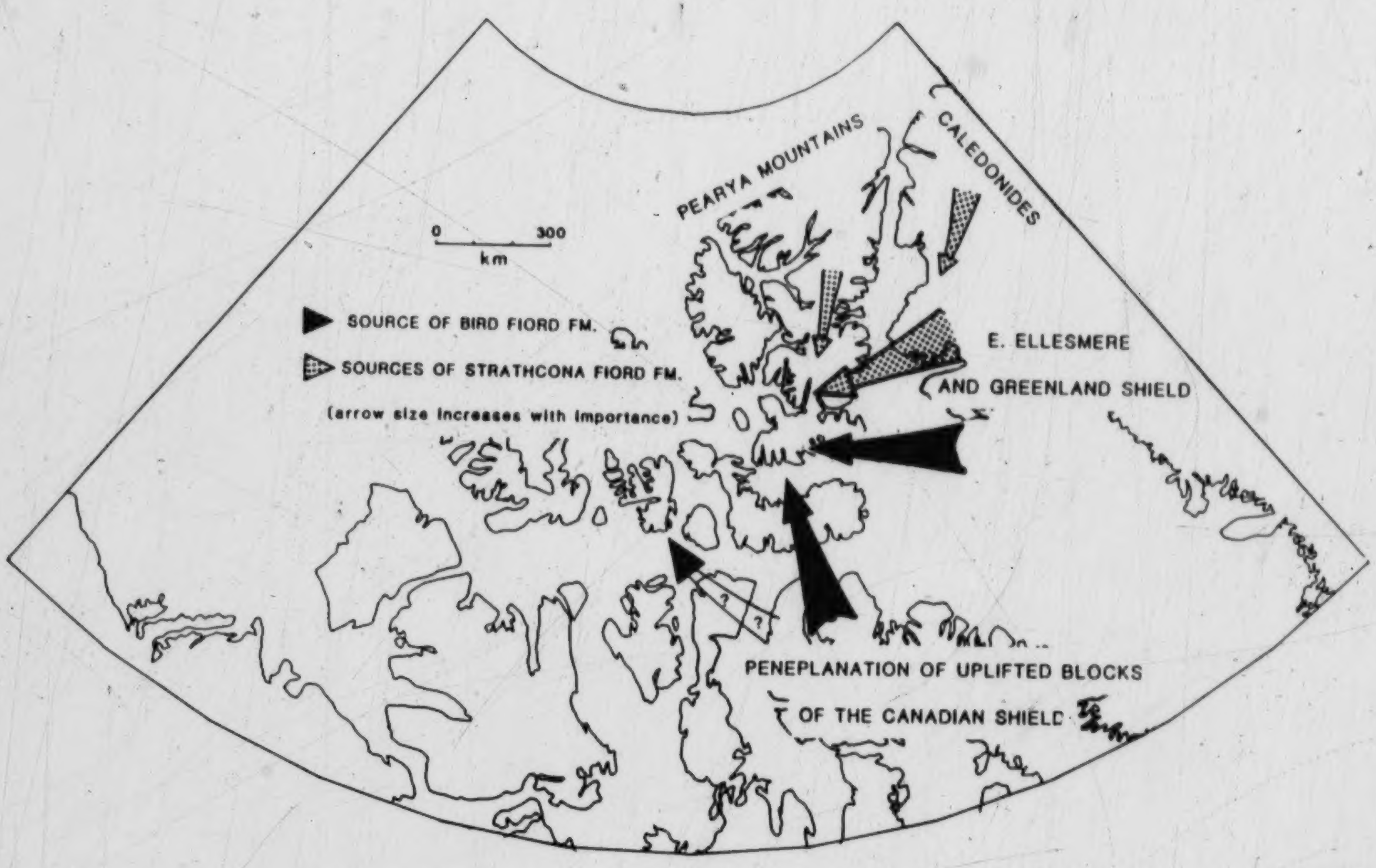
The clastic portion of the Bird Fiord Formation includes rocks deposited in environments ranging from fluvial, through a spectrum of shelf environments, to a distal shelf setting. The excellent exposures provide a unique opportunity to examine rocks deposited in a spectrum of shelf environments.

DISCUSSION

The Bird Fiord Formation shelf was approximately 200 kilometers wide (Text-figs. 7.7, 7.8 and 7.9). An isochronous shoreline to slope transect (Text-fig. 7.1) crosses several shelf depositional environments as shown by lateral changes in the stratigraphy of the Bird Fiord Formation (slope = Cape De Bray Formation: distal shelf = member C unit 1: proximal shelf = member C unit 2: marginal shelf = member C on southwest Ellesmere Island: nearshore shelf/shoreface/shoreline/delta margin = member D: fluvial = ?some of member D, member E, + Strathcona Fiord Formation and a portion of the Hecla Bay Formation). The sedimentological characteristics of each stratigraphic division of the Bird Fiord Formation can be used to illustrate depositional style in different portions of the shelf (Text-fig. 9.8).

The Bird Fiord Formation is characterized by repetitive rhythmic sedimentation. What is apparent is that the scale of rhythm increases distally from the shoreline (Text-fig. 9.8). A similar trend was hinted at by Brenner (1980) and Bouma *et al.* (1981) who compared shelf coarsening upward sequences in deposits of the Cretaceous and Jurassic North American epicontinental seaway. Coarsening upward sequences formed distant from the shorelines of the Mesozoic seaway (portions of the Sundance Formation, the Shannon, Sussex and Hygiene sandstones of the western interior United States) are considerably thicker than coarsening upward sequences formed in a more nearshore shelf setting (the Woodside unit of the Ferron Sandstone - Cotter, 1975). Shoreward of the Woodside unit, coarsening upward sequences become indistinguishable due to the reworking and amalgamation of storm sandstones (the Washboard unit of the Ferron Sandstone - Cotter, 1975).

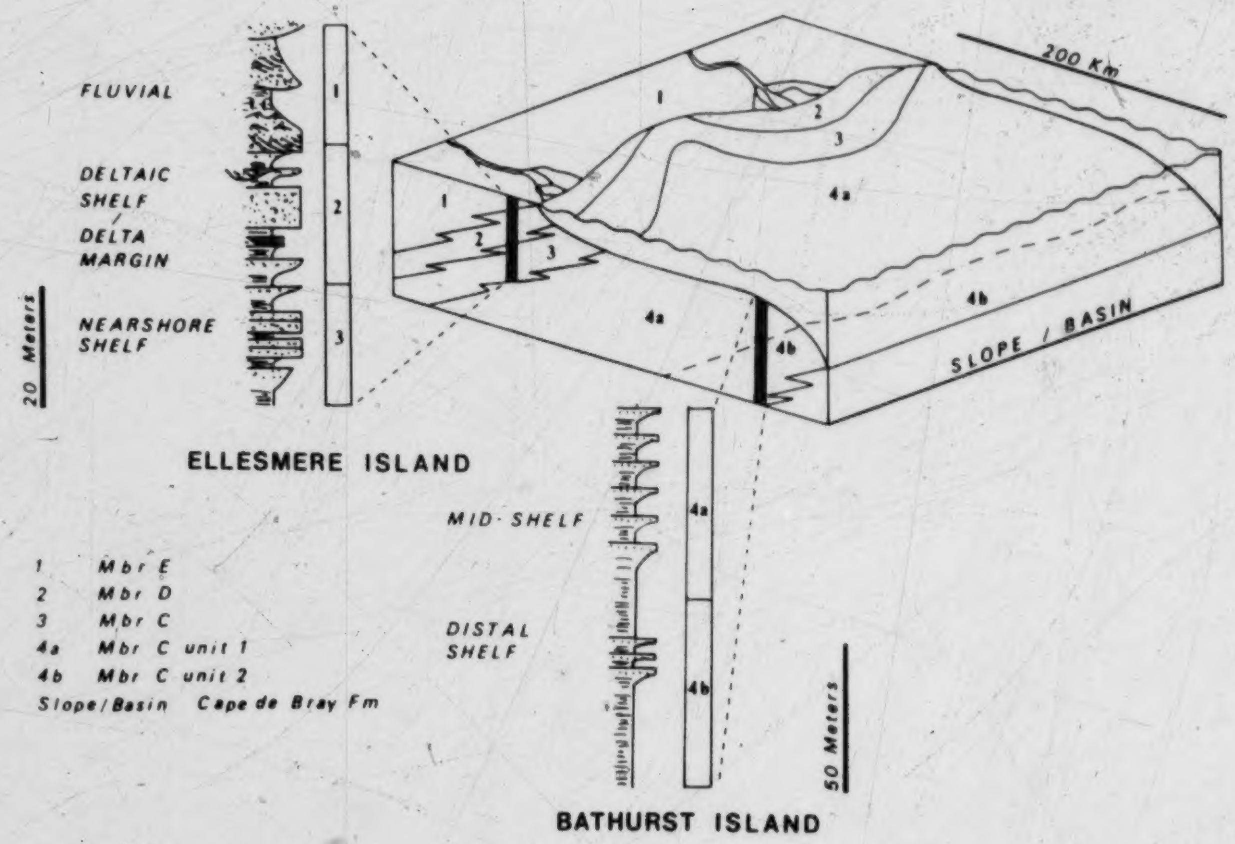
The Bird Fiord Formation differs from the Mesozoic Sundance, Shannon, Sussex and Hygiene sandstones of the western interior United States because it resulted from deposition on a sand-rich shelf. The Jurassic and Cretaceous marine sandstones are thought to represent distinct sand sheets (Beaumont, 1984; Rice, 1984) on muddy shelves, each distinct sand sheet being the result of a different deltaic pulse (Bouma, 1981; Brenner, 1980; Porter, 1976). Sands



PEARYA MOUNTAINS
CALEDONIDES
0 300
km
▶ SOURCE OF BIRD FIORD FM.
▨ SOURCES OF STRATHCONA FIORD FM.
(arrow size increases with importance)
E. ELLESMERE
AND GREENLAND SHIELD
?
?
PENEPLANATION OF UPLIFTED BLOCKS
OF THE CANADIAN SHIELD

Text-figure 9.7:Clastic sources: Franklinian Geosyncline, Middle Devonian brought onto the Mesozoic shelf (bypassing the shoreline through storm entrainment) were winnowed and redeposited on the shelf in the form of locally developed bars. These bars were individual bedforms in larger shelf sandstone bodies or sheets (Shurr, 1984). Repeated storm events were responsible for most of the bar movement and associated deposition (Brenner, 1980; Porter, 1976).

The thicker, more discrete coarsening upward rhythms in the Bird Fiord Formation (member C unit 1), herein considered as distal shelf deposits, represent distinct shelf sediment pulses. The top sand rich part of each large scale rhythm represents a large shelf sand body or sand sheet. This is composed of several thin sand sheets shown in outcrop as capping the small scale coarsening upward rhythms. The shelf shale/siltstone facies (the recessive lower part of the large scale coarsening rhythm) represents sedimentation before progradation of sand-sized material to the area (Text-fig. 9.9). A distal position on the shelf resulted in less sand making its way out from the shoreface and proximal shelf areas. Sand was supplied intermittently to the distal shelf as a result of regressive deltaic advances (evident in the Strathcona Fiord and Hecla Bay formations to the east). Sediment was transported along and across the shelf in the form of sand sheets (Rice, 1984; Shurr, 1984) by the activity of shelf currents (Porter, 1976) and storm activity. This westward movement is indicated by paleocurrent evidence (Text-fig. 9.5), and by

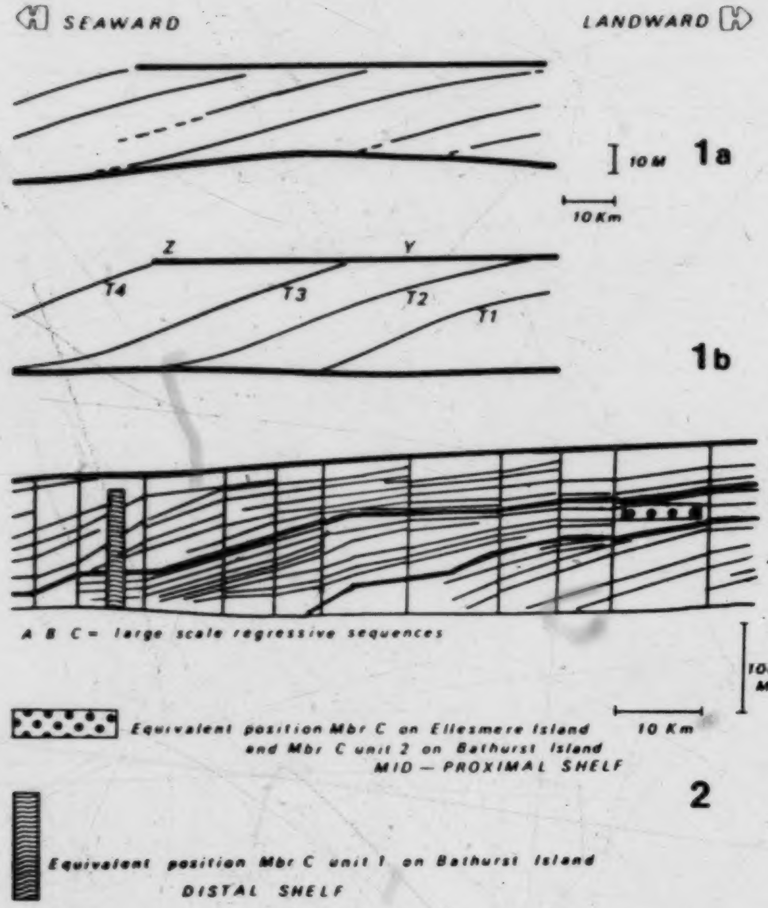

FLUVIAL
DELTAIC SHELF / DELTA MARGIN
NEARSHORE SHELF
20 Meters
1
2
3
4a
4b
SLOPE / BASIN
200 Km
ELLESMERE ISLAND
MID-SHELF
DISTAL SHELF
50 Meters
BATHURST ISLAND
1 Mbr E
2 Mbr D
3 Mbr C
4a Mbr C unit 1
4b Mbr C unit 2
Slope/Basin Cape de Bray Fm

Text-figure 9.8: Sedimentological style in different shelf environments: clastic part of the Bird Fiord Formation.

the diachronous migration of facies belts westward through time (Text-figs. 7.7, 7.8, and 7.9).

The mid-shelf is characterized by stacked shale → siltstone → sandstone rhythms 3-8 meters thick. This part of the shelf received a more continuous supply of sand sized material. This is indicated by the sandier nature of the deposits, and the lack of the basal recessive part of the 'large scale rhythms' characteristic of the distal shelf.

Cant (1984), working on the Spirit River Formation of Alberta, noted small scale coarsening upward rhythms 5-10 meters thick in marine shelf deposits. These occur within larger scale (30-50 meter thick) transgressive-regressive coarsening upward sequences which are capped by fluvial deposits in the direction of provenance. Cant (1984) proposed a model, based on seismic and electric log correlation, which showed the minor shelf sequences making up a series of imbricated seaward sloping surfaces of deposition in each major regressive sequence (Text-fig. 9.9). According to Cant (1984), in the Spirit River Formation setting (very low shelf gradients, shallow water, high wave energy and no shelf-slope break) sedimentation occurred on the epeiric sea 'shelf' by seaward accretion of evenly sloping bodies of sediment. A similar series of seaward sloping minor sequences (rhythms) inside larger scale sequences is shown in Mitchum *et al.* (1977) and is reproduced in part in Text-figure 9.9.


SEAWARD
LANDWARD
10 M
10 Km
1a
Z
Y
T4
T3
T2
T1
1b
C
B
A
A B C = large scale regressive sequences
100 M
10 Km
Equivalent position Mbr C on Ellesmere Island and Mbr C unit 2 on Bathurst Island
MID — PROXIMAL SHELF
2
Equivalent position Mbr C unit 1 on Bathurst Island
DISTAL SHELF

Text-figure 9.9:

1. After Cant (1984).

a. Diagram of Fahler 'E' cycle of the Spirit River Formation, Alberta, showing correlation of minor cycles within this larger scale cycle. These correlations are believed to represent original depositional surfaces.

b. Hypothetical sequence with time lines on it. The upper boundaries are at first surfaces of sedimentation, then surfaces of sediment bypassing. For example at time T3 position Y was receiving active sedimentation. By T4 Y was in the zone of bypass while Z was a site of deposition. In this way the shelf shows a series of stacked minor sequences (rhythms) which aggrade seaward.

2. After Mitchum *et al.* (1977)
Subsurface section of part of the Spirit River Formation of western Canada. A, B and C represent large scale regressive depositional sequences composed of small scale sequences showing marked progradation into deeper water (to the left). The equivalent positions of the Bird Fiord Formation clastic units is marked. Member C on Ellesmere Island and Member C unit 2 on Bathurst Island and Grinnell Peninsula represent a proximal/mid-shelf position within a single large scale sequence, or in more than one sequence between which the boundaries are not distinguished. Member C unit 1 on Bathurst Island lies in a distal shelf position. Sands in each pulse (large scale sequence) only reach the distal area near the point of maximum regression. The large scale rhythms in Text-figs. 6.3 and 6.4 represent distinct large scale shelf accretion sequences such as A, B and C.

The geologic setting of members C and D of the Bird Fiord Formation on southwest Ellesmere Island is similar to that setting described for the Spirit River Formation (Cant, 1984). There appears to have been a shelf with low gradient (indicated by the layercake stratigraphy of the Bird Fiord Formation in this area), high clastic influx, and shelf process dominance. The small scale rhythms characteristic of the 'mid-shelf' of the Bird Fiord Formation (Text-fig. 9.8) resulted from variation in clastic influx. This was of short time duration and of local extent, and was caused by minor deltaic advances and changes in direction of clastic input onto the shelf through avulsion of distributary channels. The sediment provided to the shelf was distributed by storm and fairweather processes to form a series of aggrading thin sand sheets. These thin sand sheets are seen now as the capping sandstones of the small scale rhythms in members C and D . There is no evidence of distinct barforms such as illustrated in a shelf setting by Shurr (1984). Individual sand units in member C (on both Ellesmere and Bathurst islands) are never seen to pinch out in surface sections; nor do they show lateral variation as do Shurr's (1984) "small scale facies packages". Such lateral transitions would be expected if sand movement on the Bird Fiord shelf occurred primarily through the medium of migrating barforms. Such barforms are indicated on Grinnell Peninsula by cross stratified sandstones capping coarsening-upward rhythms (Plate 31 fig. 1). In this area poor outcrop hampers investigation of the distribution and sedimentology of the shelf sandstones, and the definition of shelf barforms as opposed to shelf sheets. These thin widespread sheets resulted from storm and intense fairweather redistribution of material on the shelf.

Cant's (1984) model of seaward sloping imbricated sediment sheets (Text-fig. 9.9) is the most applicable to the sandy shelf deposits of the Bird Fiord Formation. The Bird Fiord shelf appears to have been a gently seaward sloping ramp. Exposure of the Bird Fiord Formation is largely confined to sedimentological strike. Dip exposures such as the cliffs on North Kent Island are not long enough to show the expected imbrication of the thin sand sheets away from the clastic source(s). Cant (1984) estimated a gradient of 0.17 meters per kilometer for the Spirit River setting. At this slope imbrication will only be seen in extensive subsurface correlations. This low gradient also helps to explain the fact that the sand sheets were never seen to pinch out in sections. The low gradient on the shelf would mean a very gradual transition between areas of different process dominance, and hence a very gradual change in sediment type on a single depositional surface on the shelf. Lateral facies transitions would only be seen in very extensive dip exposures.

Subsurface work is needed for the Bird Fiord Formation to show:

1). if northward sloping downward convergence and downlapping (Mitchum *et. al*, 1977) of the sand sheets in member C on southwest Ellesmere Island and North Kent Island occurs in front of the northward advancing deltaics of member D; and

2). the direction of downward convergence and downlapping of a/. the large scale rhythms in member C unit 1, and b/. the thin sand sheets in member C unit 2, on central Bathurst Island.

Clinoforms seen on seismic in the Cape De Bray Formation and the lower Bird Fiord Formation strike NW and show progradation to the southwest (Embry, pers. comm. 1985). This is indicative of a predominant southwesterly shelf transport from an easterly/northeasterly source.

X. CONCLUSIONS

Introduction

The results of this study can be partitioned into two categories; 1. Those that pertain directly to the Bird Fiord Formation, and 2. Those that pertain to stratigraphically and geographically adjacent formations. These will be discussed separately.

A. CONCLUSIONS: BIRD FIORD FORMATION

Age

The Bird Fiord Formation at Bird Fiord, Ellesmere Island, ranges from late Emsian (late *serotinus* Zone) possibly to the late Eifelian. South of Schei syncline the formation may range into the late Eifelian. The base of the Bird Fiord Formation on Grinnell Peninsula (above the Blue Fiord/Disappointment Bay Formation carbonate) is late early Eifelian (*costatus costatus* Zone). The upper part of the formation is estimated to be Eifelian to Givetian in age. On central Bathurst Island (Dundee Bight area) the base of the formation is dated as late early Eifelian (? *costatus costatus* Zone); the top of the formation is within the Givetian (palynological results from samples at the top of the formation have not been received at the time of writing).

Stratigraphy and Sedimentology

The Bird Fiord Formation is variable in thickness and stratigraphy. Three areas are delineated on the basis of stratigraphy. These are;

i. North of Schei syncline between Bird and Sor Fiords.

ii. South of Schei syncline east from Arthur Fiord, Grinnell Peninsula to Grise Fiord, Ellesmere Island.

iii. Bathurst Island, and Grinnell Peninsula west of Arthur Fiord.

i. The Bird Fiord Formation at Bird Fiord is approximately 800 meters thick. It is divided into two members similar to the division of the formation in Geological Survey of Canada Map 1312A. This twofold division breaks down east of Bird Fiord where the Bird Fiord Formation interdigitates with the Strathcona Fiord Formation. The lower member of the Bird Fiord Formation (member F of this thesis) is divided into five units which range in environment from shallow marine/lagoonal impure carbonates and calcareous clastics to prodelta silts and shales. This member may be lithostratigraphically equivalent to members A, B, and C of the Strathcona Fiord Formation in the vicinity of Vendom Fiord (Roblesky, 1979, section 4, page 106). The upper member of the Bird Fiord Formation comprises shallow marine/shoreline and possibly fluvial sandstones. This member (member D of this thesis) may be lithostratigraphically equivalent to Roblesky's (1979) member D of the Strathcona Fiord Formation in the region of

Vendom Fiord.

Member F units 1 and 2 appear time equivalent to the basal portion (unit 1 member A) of the Bird Fiord Formation in the Goose Fiord area.

ii. South of Schei syncline the Bird Fiord Formation is approximately 550 meters thick. It can be divided into members A, B, C and D which occur throughout this area, and member E which is apparently confined to the extreme eastern part of this area. The two lowest members (A and B) are carbonate dominated and represent a transgressive change from sabkha to lagoonal/shallow shelf settings. Members C, D, and E represent a regressive clastic sequence from very proximal shelf to shoreline to deltaic environments.

iii. The Bird Fiord Formation on Bathurst Island and Grinnell Peninsula comprises two clastic members (C and D) which reflect a regressive change from distal shelf through proximal shelf to shoreline and delta margin environments. The formation thickens significantly westwards in the region of central Bathurst Island (Ormiston, 1967; Kerr, 1974; this study) from 600 meters on Grinnell Peninsula and eastern Bathurst Island to 900 meters in the Dundee Bight area.

Member A on southwest Ellesmere is time-equivalent to a possible disconformity on Grinnell Peninsula, to the uppermost part of the Disappointment Bay Formation on

Cornwallis and eastern Bathurst Islands, and to shales and siltstones on central Bathurst Island. Member B is time equivalent to a limestone unit on Grinnell Peninsula and eastern and central Bathurst Island (termed the Bird Fiord Formation carbonate equivalent in this thesis), and to part of the Eids Formation on western Bathurst Island. Upper portions of the Bird Fiord Formation on western Grinnell Peninsula and Bathurst Island are time-equivalent to the lower part of the Hecla Bay Formation.

The carbonate phase of the Bird Fiord Formation (members A, B, and F) ranges in age from early late Emsian (late *serotinus* Zone) to late early Eifelian *costatus costatus* Zone). During this time interval the Bird Fiord Formation was restricted to Ellesmere Island and northwest Devon Island east of Arthur Fiord. This portion of the formation was deposited in shallow shelf, lagoonal, to shoreline settings. This shelf possessed a northward deepening facies hinge roughly coincident with the axis of Schei syncline, Eastward equivalents to the carbonate part of the Bird Fiord Formation are in the lower portion of the Strathcona Fiord Formation (possibly members A, B and C of Roblesky's 1979 section 4, p. 106). Southern and western equivalents include the uppermost portions of the Blue Fiord/Disappointment Bay Formation and the Bird Fiord Formation carbonate equivalent on Grinnell Peninsula, Cornwallis Island and eastern Bathurst Island, and siltstones and shales of the Eids Formation (discussed later in the text) on central and western Bathurst Island.

Clastic influx was present, but was low, during deposition of the carbonate portion of the Bird Fiord Formation. The relative rate of clastic influx to carbonate production increased at the base of member C of the Bird Fiord Formation on southwestern Ellesmere Island (late *costatus costatus* Zone) and at the base of member F unit 5 north of Schei syncline. These intraformational contacts on Ellesmere Island are approximately coincident with the base of the Bird Fiord Formation on Grinnell Peninsula, Cornwallis and Bathurst Islands.

The clastic portion of the Bird Fiord Formation (members C, D, and E) records a general westerly advance of deltaic facies 'pushing' distal and proximal shelf facies westward in front of it. Distal shelf deposits are not present on southwest Ellesmere Island. This area appears to have been proximal and relatively shallow throughout deposition of the entire Bird Fiord Formation.

Reference sections:

The type section of the Bird Fiord Formation is poorly exposed. Much better sections were found on the north side of Bird Fiord (sections 81E and 81F of this thesis). Because a designated type section is inviolate (Code of Stratigraphic Nomenclature, 1970), it is recommended that these two nearby, contiguous sections be considered important reference sections for the Bird Fiord Formation.

The uppermost portion of the formation is not exposed in them, but the contact with the overlying Strathcona Fiord Formation may be seen in Thorsteinsson and Kerr's (1972) type section (83CV of this thesis; lithological logs are provided in the rear fold).

The regional inhomogeneity of the Bird Fiord Formation prompts the designation of two other reference sections. A superb cliff section of the Bird Fiord Formation is exposed on the east coast of North Kent Island (section 81H of this thesis: Plates 25 and 26). This section shows the internal stratigraphy of the formation on Ellesmere Island south of Schei syncline. In addition, this locality (when viewed looking westward from Blubber Point, Ellesmere Island) provides a vista of the stratigraphic setting of the Bird Fiord Formation lying above the Blue Fiord/Disappointment Bay Formation and underlying the Okse Bay Group.

The Bird Fiord Formation is well exposed in cliffs north of Half Moon Bay on the east side of Dundee Bight, Bathurst Island (section 80X this study: Pl. 32). There the entirely clastic Bird Fiord Formation overlies a very thin tongue of carbonates (the Bird Fiord Formation carbonate equivalent) separating it from the shales and siltstones of the Eids Formation. The upper boundary with the Hecla Bay Formation (no Strathcona Fiord Formation lithologies overlie the Bird Fiord Formation on Bathurst Island) is taken at this locality at the base of a continuous white and yellow weathered sandstone in excess of 30 meters thick (Pl. 32).

Embry (1976) and Embry and Klovan (1976) placed the boundary between the two formations beneath the large channel figured in Pl. 36, fig. 3. On eastern Melville Island the contact between the Weatherall Formation and the Hecla Bay formations is positioned beneath the first thick white weathering sandstone unit overlying brown terrain of the uppermost Weatherall Formation. The author has examined this contact on Melville Island and considers that the placement of the contact between the Bird Fiord and Hecla Bay formations at the base of the first sandstone in excess of 30 meters thick in section 80X would serve to standardize the boundary between these two sections.

Comparison of these reference sections affords an impression of the variation in stratigraphy and sedimentology within the Bird Fiord Formation.

B. CONCLUSIONS: ADJACENT FORMATIONS

Bird Fiord Formation carbonate equivalent

This study has shown the time equivalence of carbonates on Grinnell Peninsula, Cornwallis and Bathurst Islands to the carbonate portion of the the Bird Fiord Formation. The youngest of the equivalent carbonates, herein termed 'The Bird Fiord Formation carbonate equivalent' has been variably assigned to the Blue Fiord Formation (Geological Survey of Canada literature to date), a limestone member of the Disappointment Bay Formation (Smith, 1984), and to a distinct unit capping undifferentiated Devonian carbonates (Morrow and Kerr, 1977, Map 1421A). These previous works, and the present study, have indicated that this Bird Fiord Formation carbonate equivalent is distinct and mappable. The stratigraphic position of the unit and the work of Smith (1984; which confined the Blue Fiord Formation to north of Schei syncline, Ellesmere Island) negate assignment to the Blue Fiord Formation. The mappability of the unit, and its known age equivalence to the Bird Fiord Formation, prompt its elevation to formation status. This new formation would include carbonates capping isolated 'reefal' complexes in the subsurface of Cameron Island, and those exposed on eastern Melville Island. A type section for this formation could be set up on Grinnell Peninsula (the basal portion of either section 81A or 81B would suffice), and reference sections set up on central Bathurst Island where facies changes from shelf to deep water carbonates are present in the formation (the relevant portion of section 80X is recommended as one).

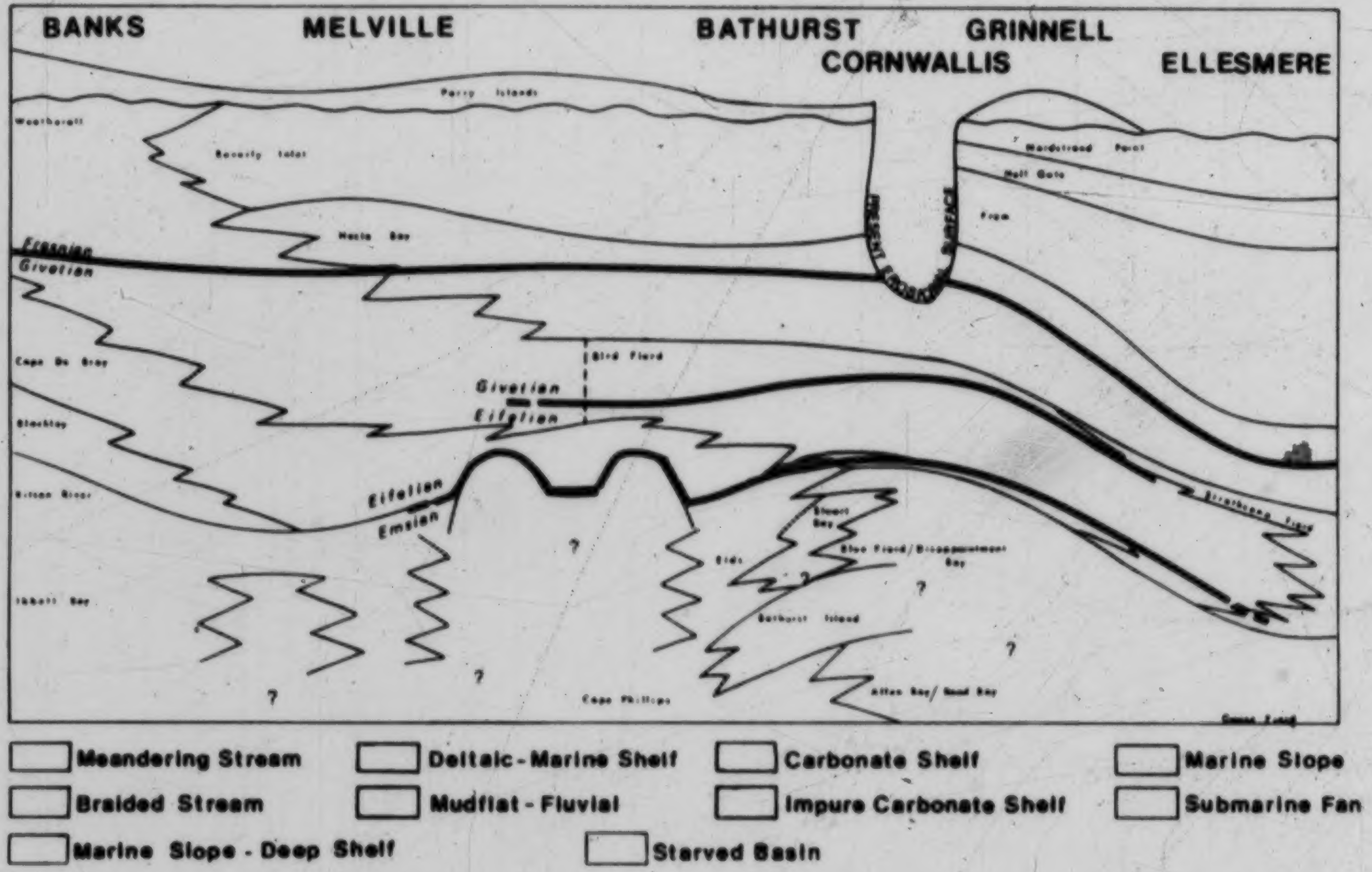
Embry and Klovan (1976) postulated a partial time equivalence for the Bird Fiord Formation on southern Ellesmere Island with the Blue Fiord Formation on eastern Grinnell Peninsula. This relationship, however, is not shown in their figure 38 (Embry and Klovan, 1976, p.580), in which they depict the lower portion of the Bird Fiord Formation on Ellesmere Island (interpreted as deltaic-marine shelf) as a facies equivalent to the Bird Fiord Formation (entirely clastics -deltaic marine shelf) on eastern Grinnell Peninsula. Recognition of this time equivalence necessitates alteration of the accepted Middle Devonian cross section of the Arctic Islands (compare Text-figs. 2.1 and 10.1). The new biostratigraphic information presented in this thesis permits the construction of a time-stratigraphic diagram for the Arctic Islands in the Middle Devonian (Table 7.1).

Cape De Bray Formation

The Eids Formation on Bathurst Island (sensu Fortier *et al*., 1963; Kerr, 1974) includes a diverse series of argillaceous and calcareous lithologies equivalent to the Disappointment Bay Formation and Bird Fiord Formation Carbonate Equivalent.

Kerr (1974) did not recognize the presence of lateral facies changes in the Bird Fiord Formation west of Dundee Bight and hence did not address the problem of nomenclature for siltstones equivalent in age to the Bird Fiord Formation.

Embry (1976) and Embry and Klovan (1976) assigned the non-bituminous upper portion of Kerr's (1974) Eids Formation on Bathurst Island to the Cape De Bray Formation. These siltstones include beds laterally equivalent to the to the lower portion of the Bird Fiord Formation west of Dundee Bight. Considerably more fieldwork needs to be done in the central Bathurst Island area to clarify Lower and Middle Devonian facies changes, and to see if differences exist


BANKS
MELVILLE
BATHURST
CORNWALLIS
GRINNELL
ELLESMERE
Parry Islands
Weatherall
Beverly Inlet
Hecla Bay
? Nordstrand Point
Hell Gate
Fram
PRESENT EROSIONAL SURFACE
Frasnian
Givetian
Cape De Bray
Bird Fiord
Givetian
Eifelian
Blackley
Kitson River
Eifelian
Emsian
Strathcona Fiord
Stuart Bay
Blue Fiord/Disappointment Bay
Eids
Ibbett Bay
Bathurst Island
?
?
?
?
?
?
Cape Phillips
Allen Bay/ Read Bay
Goose Fiord
Meandering Stream
Braided Stream
Marine Slope - Deep Shelf
Deltaic - Marine Shelf
Mudflat - Fluvial
Carbonate Shelf
Impure Carbonate Shelf
Starved Basin
Marine Slope
Submarine Fan

Text-figure 10.1: Regional cross section, Devonian, Arctic Islands, based on results of this thesis. Compare to text-figure 2.1

between those siltstones equivalent to the Bird Fiord Formation carbonate equivalent and those equivalent to the lower portion of the Bird Fiord Formation.

I. PLATE DESCRIPTIONS
PLATE 1

Figure 1. Vuggy massive dolomitic siltstone intervals interbedded with planar laminated dolomitic siltstones. Section 82A2 1.0 meters Member A unit B.

Figure 2. Close-up of vuggy interval with planar laminated to massive silty dolostones. Note 'teepee structure' in laminated intervals at lower center. Section 82B3 92.1 meters above section base. Member A unit 3.

Figure 3. Right angles to bedding showing planar laminated dolomitic siltstone/silty dolostones. Section 82C1/83 31.0 meters above section base. Member A unit 3.

Figure 4. Right angles to bedding in planar laminated dolomitic siltstone/silty dolostone. Note disruption of laminae by mudcracking (above face of hammer). Section 83B 8.0 meters above section base. Member A unit 2.

Figure 5. Right angles to bedding. Planar laminated dolomitic siltstone showing intraclastic layers, tepee structures and cryptalgal mounding. Section 82C1 51.3 meters above section base. Member A unit 1.

Figure 6. Bedding plane exposure of dolomitic siltstones showing polygonal mudcracking. Section 82A2 110.0 meters above section base. Member A unit 2.

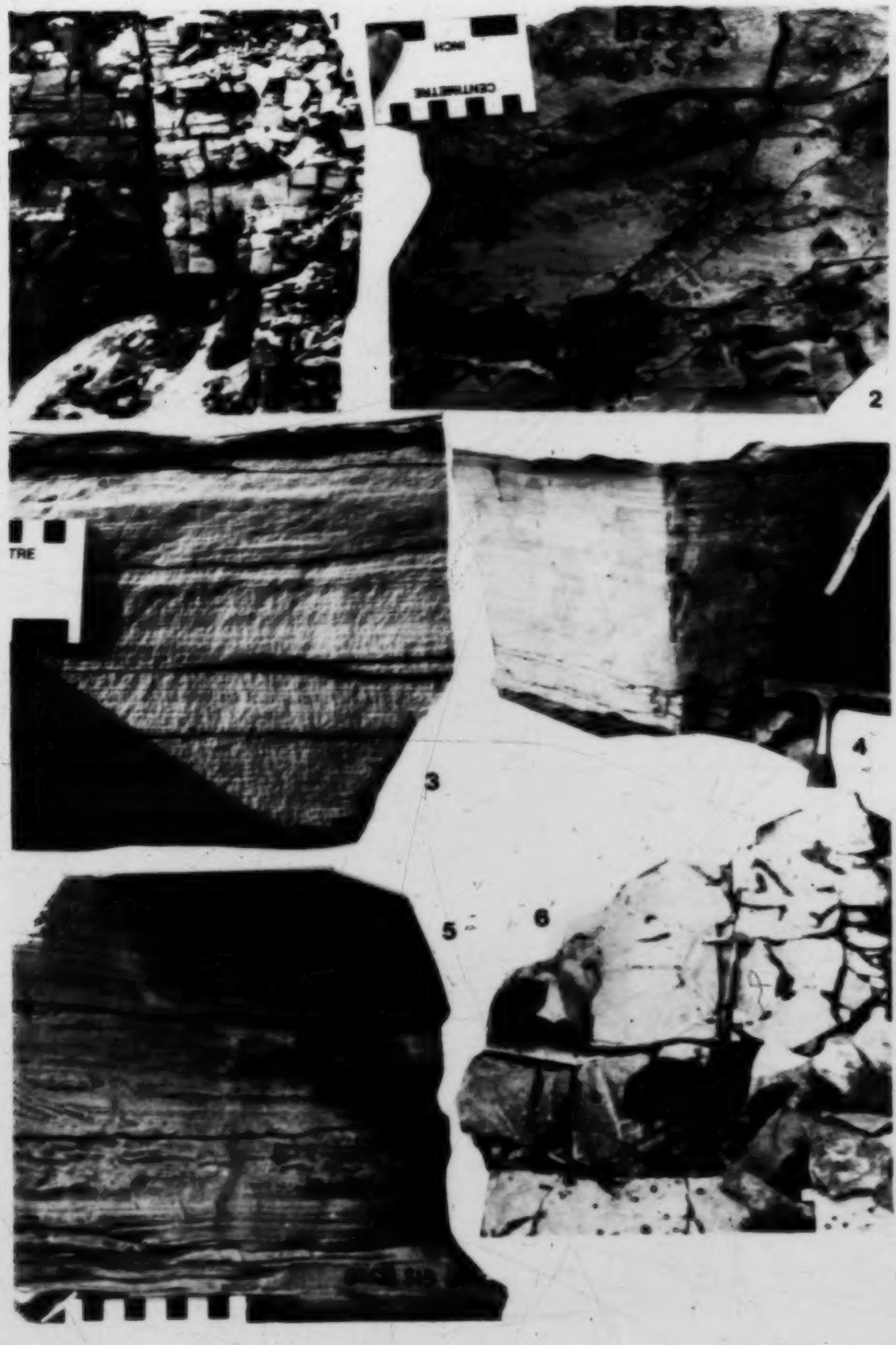
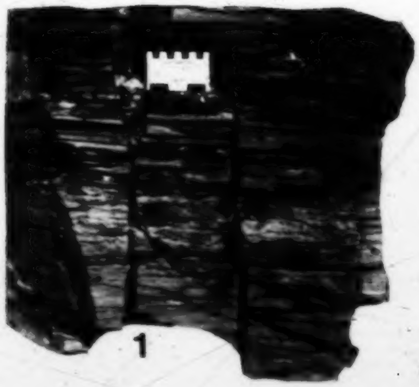

1
INCH
CENTIMETRE
2
TRE
3
4
5
6

PLATE 2

Figure 1. Cryptalgal wrinkly lamination. Algal mat origin. Section 82C1 45.0 meters above section base. Member A unit 2.
Figure 2. Intraclastic conglomerate overlain by vuggy wrinkled laminite. Intertidal. Section 82C1 73.9 meters above section base. Member A unit 1.
Figure 3. Wavy cryptalgal laminite. Intertidal to shallow subtidal algal mat. Section 82B3 60.0 meters above section base. Member A lower part of unit 3.
Figure 4. Irregularily wrinkled cryptalgal dolomitic siltstone. Intertidal algal mat. Section 83B 1.3 meters above section base. Member A unit 2.
Figure 5. Negative image of thin section projection. Cryptalgal laminite. Section 82B3 55.0 meters above section base. Member A unit 2.
Figure 6. Sharp planar contact at base of photograph between planar laminated silty shale and planar wrinkly laminated slightly vuggy cryptalgal laminite. Subtidal to intertidal. Section 83B 11.3 meters above section base. Member A unit 2.
Figure 7. Massive featureless cryptalgal mounds. Shallow subtidal to intertidal. Section 83B 18.1 meters above section base. Member A unit 2.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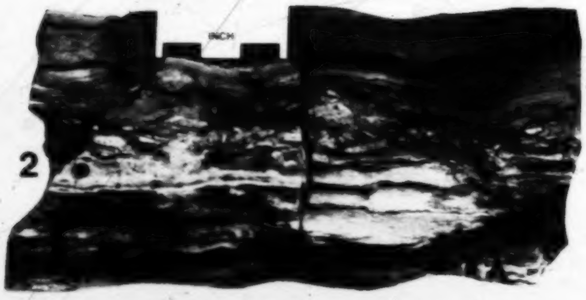
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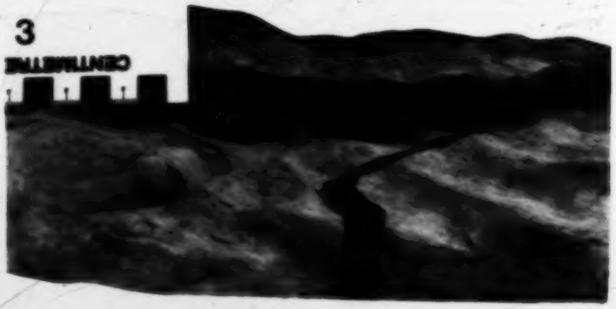
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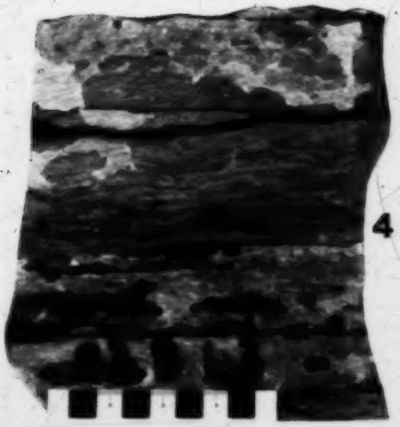
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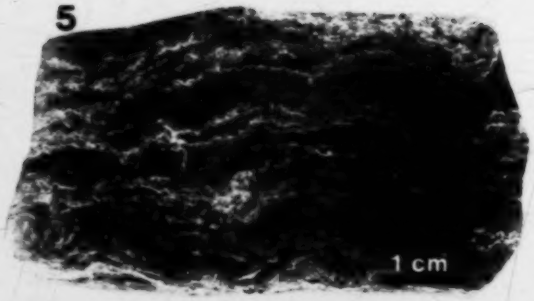
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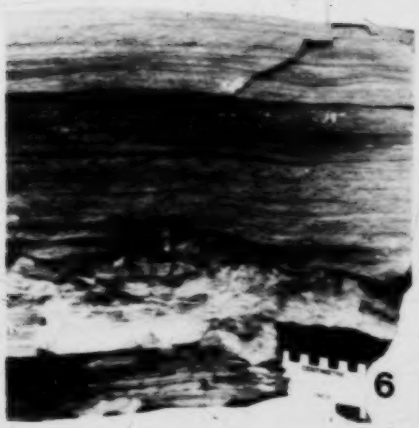
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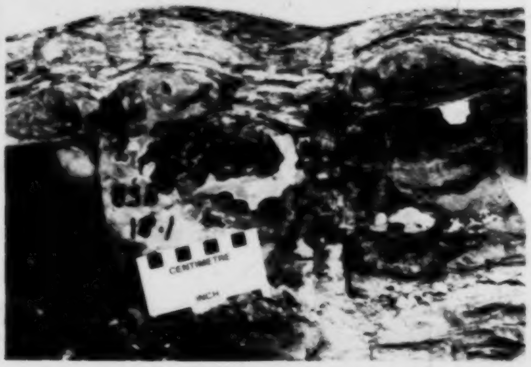
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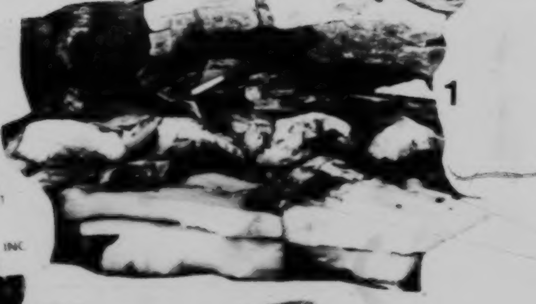
PLATE 3

Figure 1. Stromatolitic mound showing concentric laminae. Section 82C1 68.7 meters above section base. Member A unit 1.
Figure 2. Thin wrinkled cryptalgal layer. Section 82C1/83 1.0 meters above section base. Member A unit 3.
Figure 3. Thin section of portion of stromatolitic mound shown in figure 1. Note pronounced fenestrae.
Figure 4. Stromatolitic bed showing variation in pattern of algal growth between two algal generations separated by a thin argillaceous layer. Section 82C1 192.7 meters above section base. Member A unit 3.
Figure 5. Wavy cryptalgal dolomites at top of cleaning-up rhythm. Section 82B3 26.0 meters above section base. Member A unit 2.
Figure 6. Mounded stromatolitic layer of shallow subtidal to intertidal origin interstratified with intertidal planar and planar/wavy laminated dolomitic siltstones. Section 83B 31.6 meters above section base. Member A unit 2.
Figure 7. Irregularily wrinkled concentric lamination of small cryptalgal mound. Section 83B 55.0 meters above section base. Member A unit 2.



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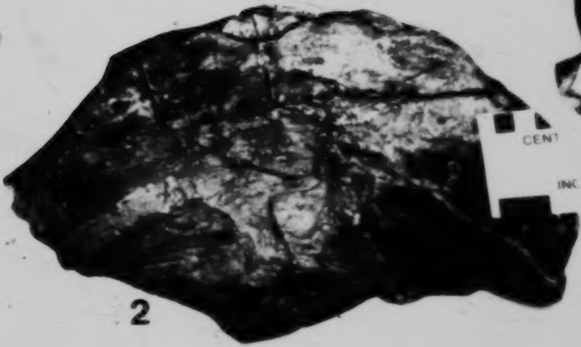

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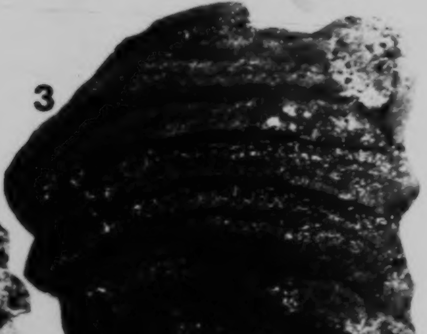

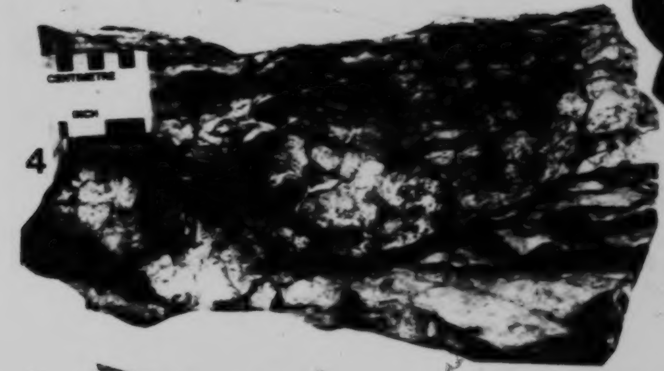
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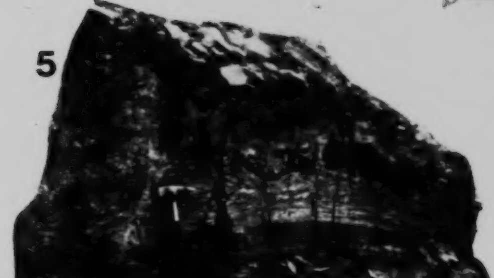

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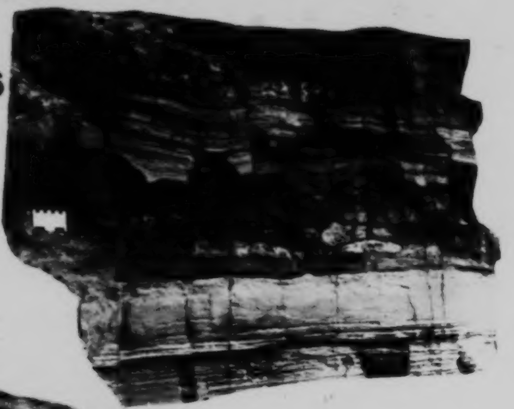

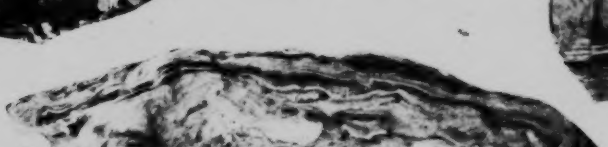
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PLATE 4

Figure 1. Variation within laminated dolostones including, in ascending order; planar to wavy laminated and massive, wavy to wrinkly laminated (note cryptalgal mounding approximately 70 centimeters from base of outcrop), and planar to wavy dolostones. Note associated compositional variation. Section 83B 24.5 meters above section base. Member A unit 2.

Figure 2. Sequence within gypsiferous dolostones. At base shows intertidal cryptalgal mounding. Recessive argillaceous dolostone above this probably subtidal grading to supratidal (at top of scale). Darker units above this subtidal to intertidal. Capped by intertidal cryptalgal mounds. Note gypsum leaching out through cleavage planes in dolosiltite of supratidal origin. Section 82B3 25.4 meters above section base. Member A unit 1.

Figure 3. Repetitive cleaning-up rhythms of shale-laminated dolostone. Section 83B 63.3 meters above section base. Member A unit 1.

Figure 4. Small intertidal channel in planar flagged planar laminated silty dolostone. Section 82C1 63.3 meters above section base. Member A unit 1.

Figure 5. Indistinct channelling within planar to wavy laminated and massive dolosiltites. Section 82A 146.0 meters above section base. Member A unit 1.

Figure 6. Close-up of cryptalgal mound from top of cleaning-up rhythm. Section 82B3 28.0. meters above section base. Member A unit 1.

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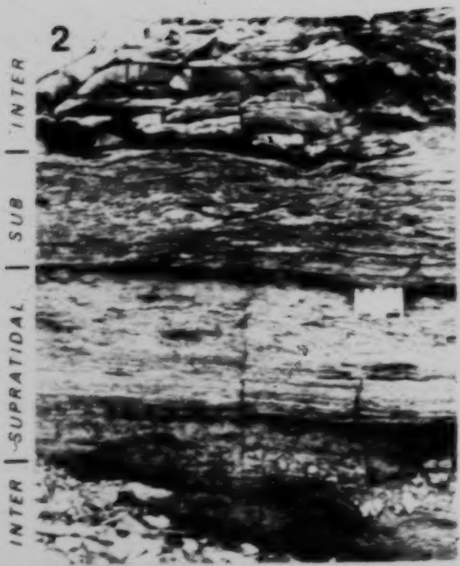
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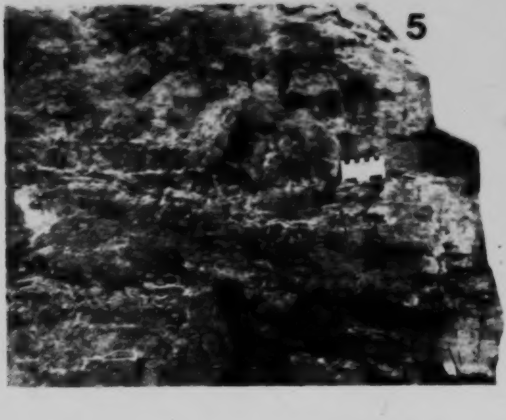

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PLATE 5

Figures 1, 3, 5. Outcrop views of algal biolithite occurring as fill to intertidal channels. Unusual occurrence in figure 5 may be due to rafting of algal clumps from an intertidal setting to a shallow subtidal setting by storm rip currents.
Figure 1. Section 82B3 112.2 meters above section base. Member A unit 3
Figure 3. Section 82A2 112.2 meters above section base. Member A unit 3
Figure 5. Section 82A2 24.0 meters above section base. Member A unit 2
Figure 2. Top surface view of clusters of 'button' stromatolites (or oncolite cluster). Section 81G 234.5 meters above section base. Member A unit 3.
Figure 4. Negative image of thin section projection. Calcareous algae. Section 82B3 107.0 meters above section base. Member A unit 3
Figure 6. Slabbed algal biolithite showing at least two different growth forms (with and without calcareous skeleton). Light grey is silty dolomite matrix. Section 82B3 112.2 meters above section base. Member A unit 3.

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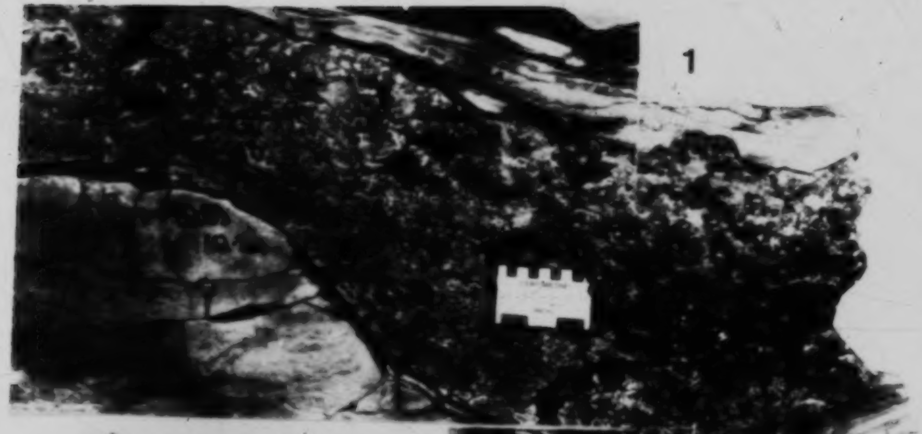

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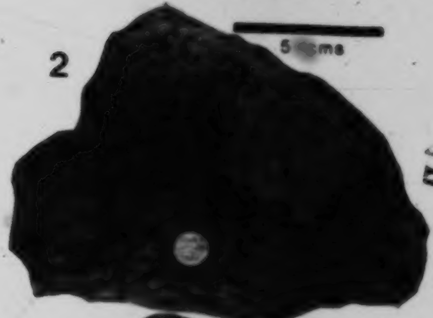

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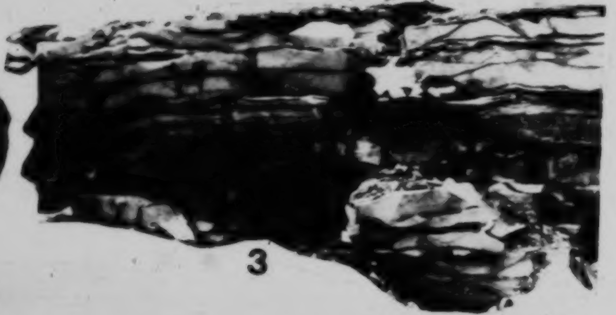

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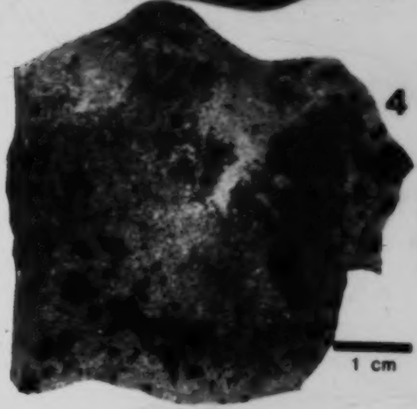

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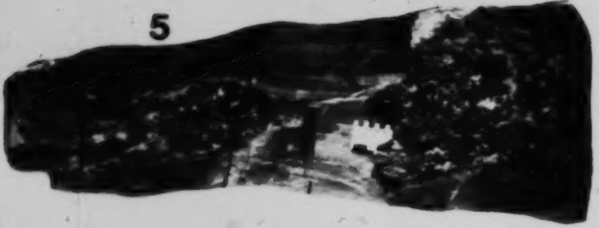

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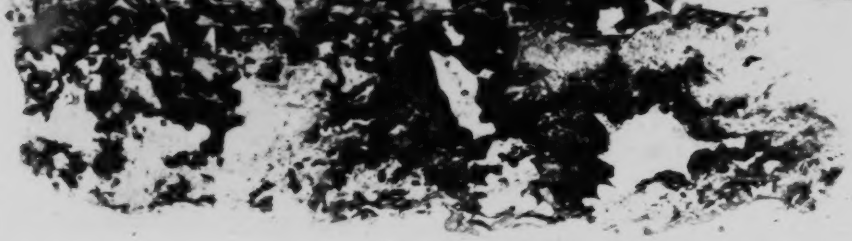

PLATE 6

Figure 1. Planar to wavy laminated silty dolostone erosively overlain by planar laminated silty dolostone. Section 82B2 4.0 meters above section base. Member A unit 3.
Figure 2. Planar to wavy laminated (oscillation ripples) dolosiltites. Section 82A 90.0 m above section base. Member A unit 1.
Figure 3. Bedding plane showing ladderback rippling. Upper part of coarsening-up rhythm. Section 82C1/83 36.0 meters above section base. Member A unit 3.
Figure 4. Lenticular bedding of siliclastic siltstones in planar to wavy laminated argillaceous dolomitic siltstones. Shallow subtidal to intertidal. Section 82A2 2.25 meters above section base. Member A unit 2.
Figure 5. Isolated ripple form. Shallow subtidal. Section 82A2 1.4 meters above section base. Member A unit 2.
Figure 6. Climbing ripples in dolomitic siltstones. Shallow subtidal to intertidal. Section 82A2 18.0 meters above section base. Member A unit 2.
Figure 7. Bedding plane exposure with interference ripples and lenticular bedding. Dolomitic siltstones. Shallow subtidal to intertidal. Section 82A2 2.25 meters above section base. Member A unit 2.
Figure 8. Mudcracked planar to wavy laminated dolomitic siltstones. Intertidal. Section 82C1/83 29.0 meters above section base. Member A unit 3.

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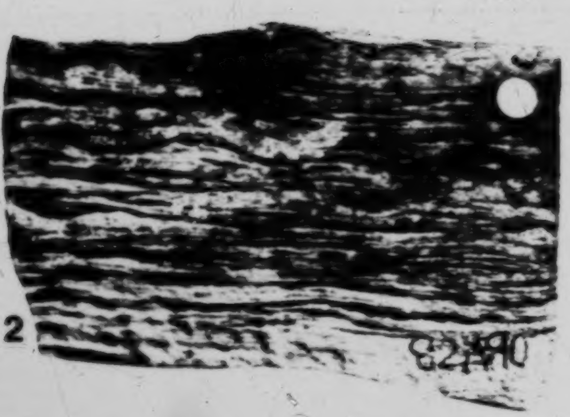

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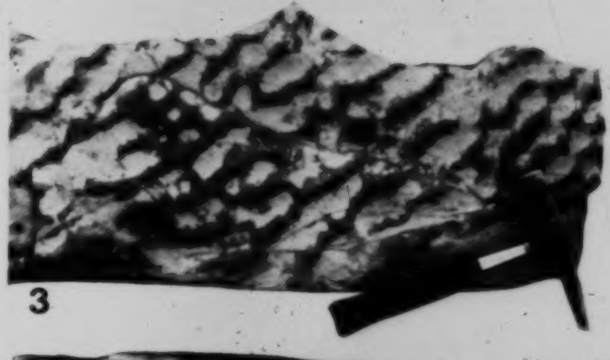

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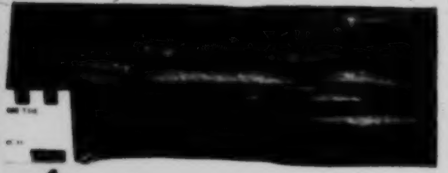

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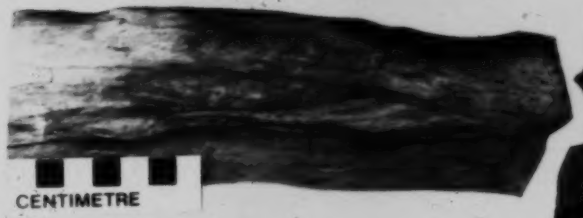
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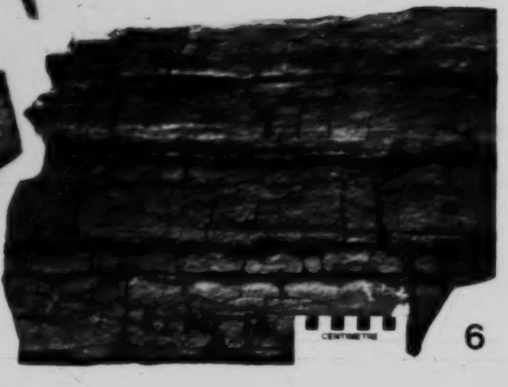
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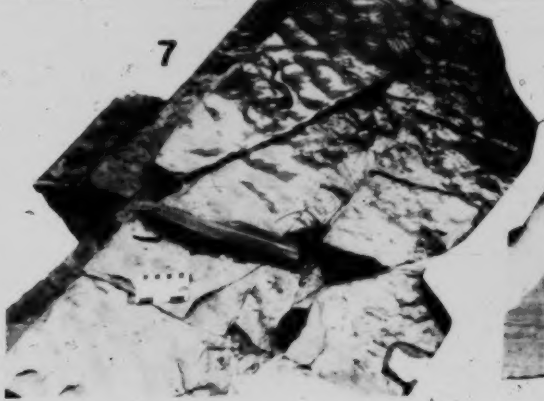

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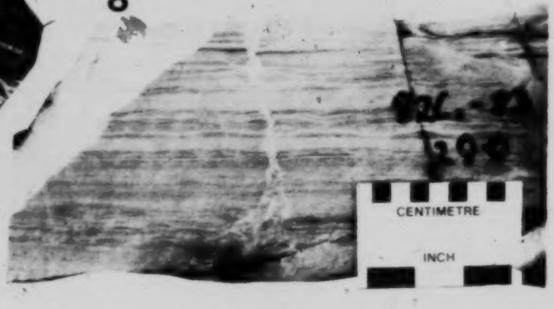
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PLATE 7

Figure 1. Gypsum saucers and laminae within dolosiltite and intraclastic dolosiltite. Supratidal. Section 81H 30.0 meters above section base. Member A unit 1.

Figure 2. Tectonically smeared gypsum of supratidal origin (on strike with chicken-wire gypsum - see figures 5, 7). Section 82B3 0.7 meters above section base. Member A unit 1.

Figure 3. Enterolithic texture. Dolomite replacement of gypsum after anhydrite. Note cryptalgal wrinkling in silty dolostone below this layer. Chaotic wrinkling in dolosiltites above enterolithic texture caused by diagenetic growth of anhydrite. Section 82A2 60.9 meters above section base. Member A unit 2.

Figure 4. Halite pseudomorphs. Section 82C1 174.5 meters above section base. Member A unit 3.

Figure 5. Nodular to Chicken-wire gypsum (originally anhydrite). Supratidal diagenetic origin. Section 82B3 3.5 meters above section base. Member A unit 1.

Figure 6. Thick (>2.0 meters) gypsum beds within planar flagged argillaceous dolosiltites. Arvid Buskas for scale. Section 81G 123.25 meters above section base. Member A unit 1.

Figure 7. Chicken-wire gypsum (after anhydrite). Supratidal diagenetic origin. Section 82B3 0.0 meters. Member A unit 1.

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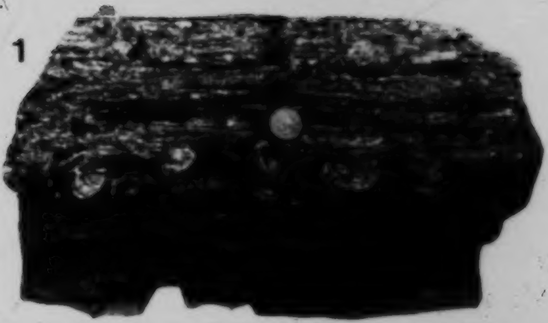

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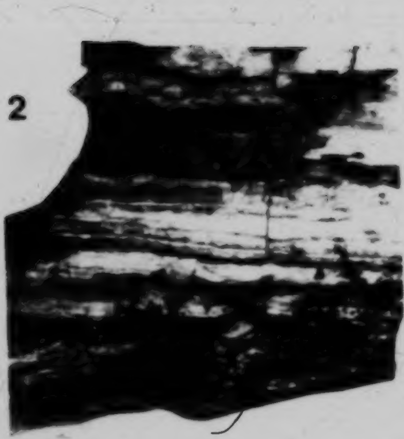

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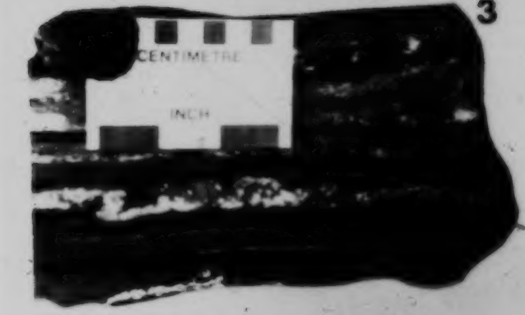
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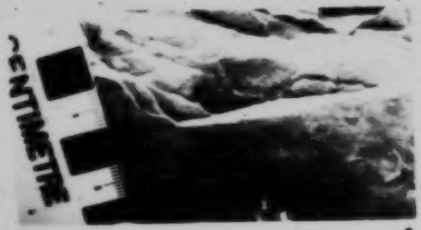
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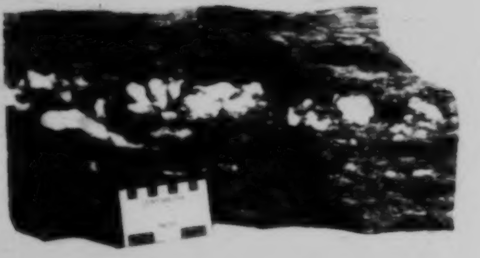

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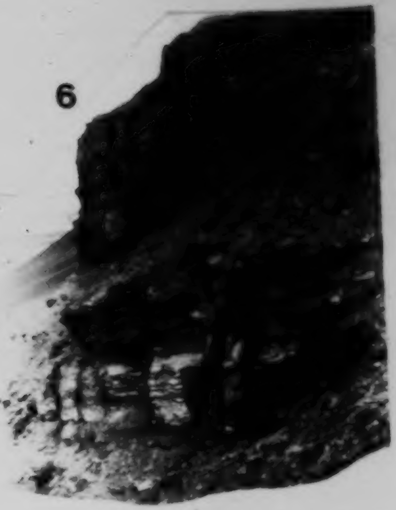

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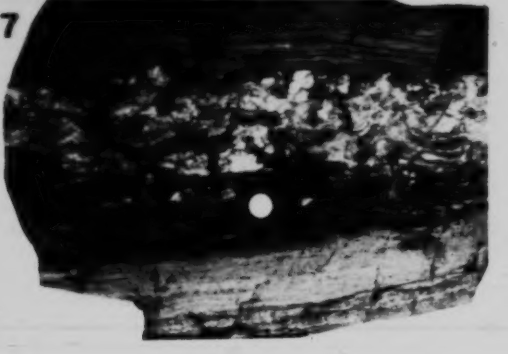


PLATE 8

Figure 1. Tectonically smeared gypsum 'laminae' and veinlets in gypsiferous dolosiltites. Base of massive gypsum bed. Section 82C1 59.0 meters above section base. Member A unit 1.

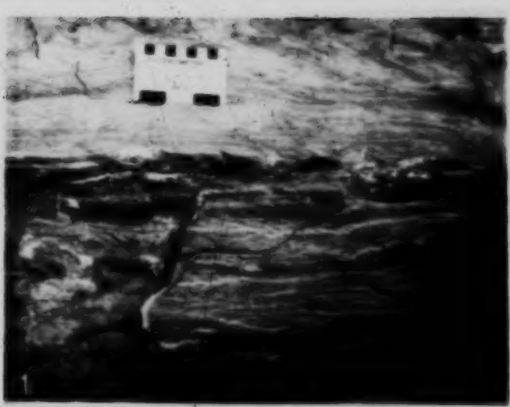
Figure 2. Gypsum crystals in thin section showing distinct shear fabric. Bar = 1mm. Section 82B3 24.0 meters above section base. Member A unit 1.

Figure 3. Negative image of thin section. Authigenic gypsum crystals within silty dolomite fining-up laminae. Bar = 5 mm. Section 82B1 0.5 meters a s.b. Member A unit 1.

Figure 4. Negative image of thin section. Vuggy massive dolomite. Note crystalline outline to vugs which were once filled with evaporitic minerals. Bar = 5 mm. Section 82C1 191.8 meters above section base. Member A unit 3.

Figure 5. Thin section. Irregularily wrinkled laminated vuggy silty dolostone showing displacive growth of gypsum after anhydrite nodules. Bar = 5 mm. Section 82C1 53.0 meters above section base. Member A unit 1.

Figure 6. Thin section. Authigenic gypsum crystals in dolomicrite matrix. Bar = 5 mm. Section 83B 21.5 meters above section base. Member A unit 2.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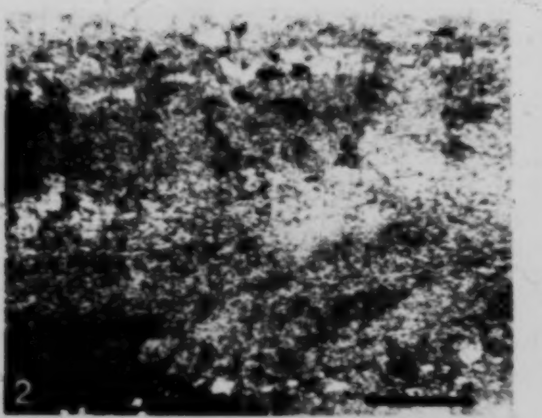
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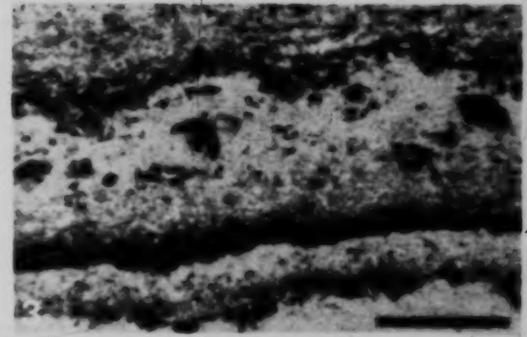

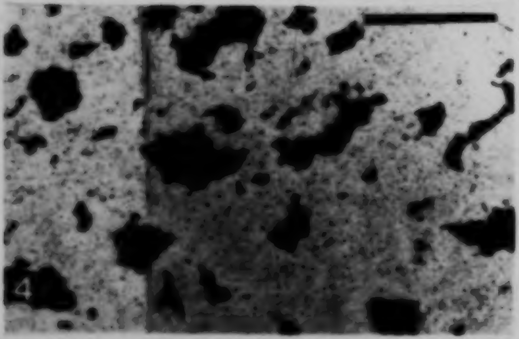
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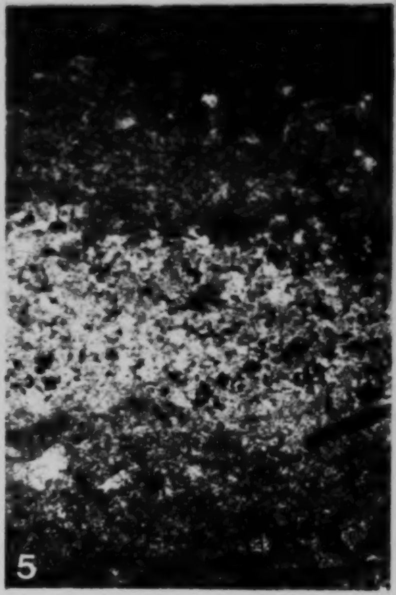
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PLATE 9

Figure 1. Bedding plane. Mudcracking in intertidal to supratidal planar laminated dolosiltites. Note presence of more than one scale of mudcracking, and the upturned dessicated edges of the large polygons. Erosion of these upturned edges and rafting of the central disk would provide intraclasts such as in figure 6. Section 82C1 approximately 60.0 meters above section base. Member A unit 1.

Figure 2. Teepee structure in massive to planar laminated silty dolostones. Intertidal to supratidal. Section 82B3 98.0 meters above section base. Member A unit 2.

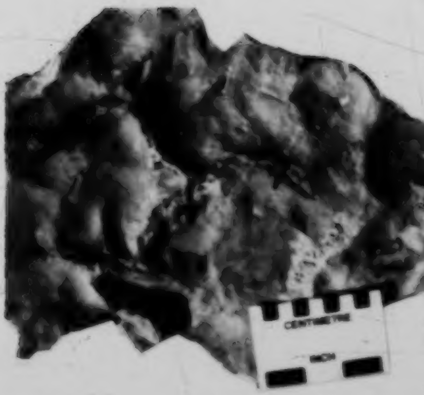
Figure 3. Lightly cemented intraclastic conglomerate with high porosity. Overlain by cryptalgal laminite. Intertidal. Section 82C1 78.5 meters above section base. Member A unit 1.

Figures 4, 5, 6, 7. Intraclastic conglomerate (rip-ups) closely associated with cryptalgal laminites. Note distinct erosion surface in Figure 7.

Figure 4. Section 82C1 71.5 meters above section base. Member A unit 1

Figure 5. Section 82C1 156.8 meters above section base. Member A unit 3

Figures 6, 7. Section 82C1 205.7 meters above section base. Member A unit 3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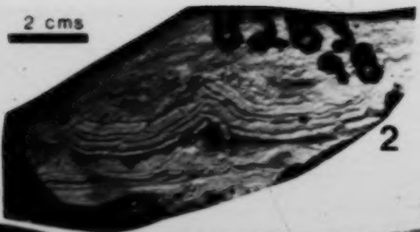

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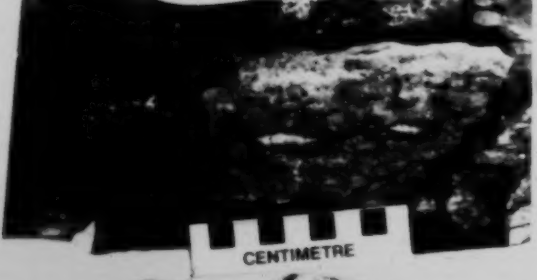
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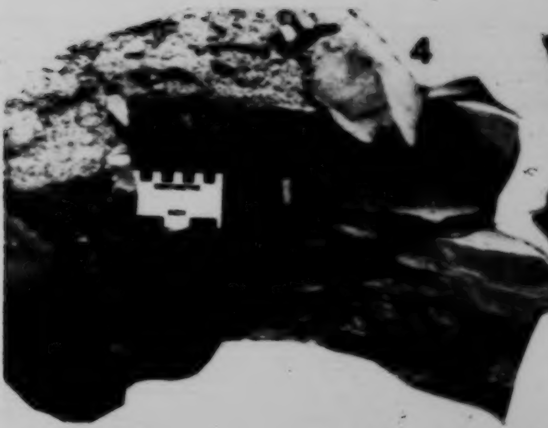

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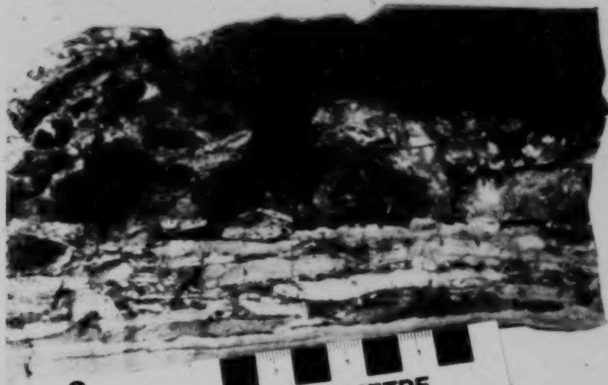
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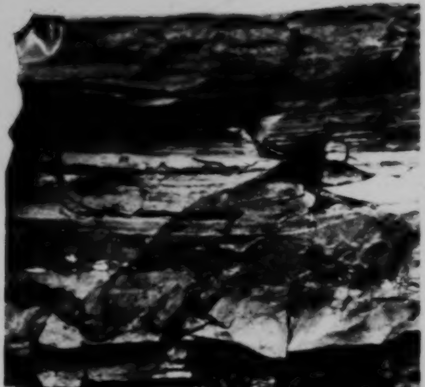
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PLATE 10

Figure 1, 2, 3, 4. 6. Chaotically wrinkled silty dolostones and dolosiltites in close association with planar laminated (intertidal/supratidal) and wrinkly laminated (intertidal algal mat) dolostones. Slumping due to dewatering and diagenetic evaporite expansion.

Figure 1. Section 82B3 60.1 meters above section base. Member A unit 2.

Figure 2. Section 82B3 30.2 meters above section base. Member A unit 1.

Figure 3. Section 82B3 97.0 meters above section base. Member A unit 3.

Figure 4. Section 82A2 64.0 meters above section base. Member A unit 3.

Figure 6. Section 82B3 96.0 meters above section base. Member A unit 2.

Figure 5. Negative image of thin section projection. Teepee structure in contorted calcareous dolomitic siltstones. Section 82C1/83 11.9 meters above section base. Member A lower part of unit 3.

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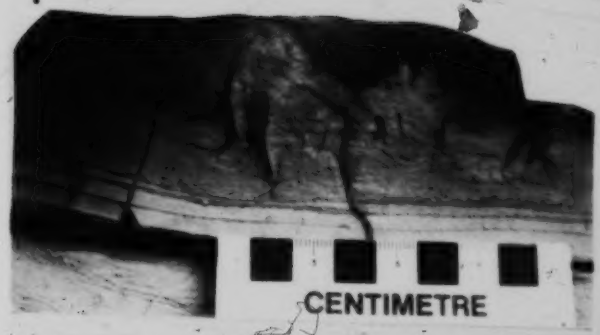
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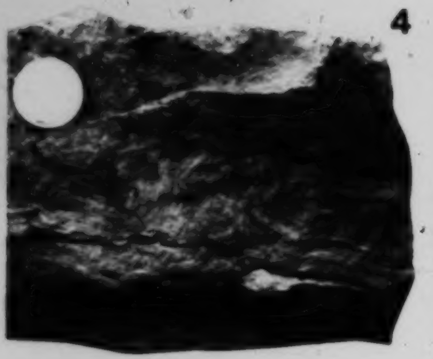

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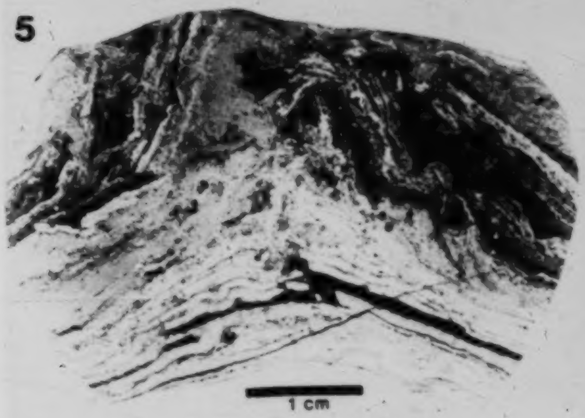
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PLATE 11

Figure 1. Regressive cleaning-up rhythm of shales to planar laminated dolomitic siltstones. Subtidal to intertidal/supratidal. Section 82C1/83 29.0 meters above section base. Member A unit 3; (See Plate 13).
Figure 2, 3. Large oscillation ripples (?antidunes) in dolomitic siltstone. Section 82B2 6.2 meters above section base. Member A unit 3 upper part.
Figure 4. Large wave ripples. Section 82B2 11.82 meters above section base. Member A unit 3 upper part.
Figure 5. Planar and wrinkle laminated intraclastic and bioclastic calcareous siltstones. Shallow subtidal to intertidal. Overlain by chaotic ?slumped dolosiltites. Section 82C1/83 11.9 meters above section base. Member A unit 3.
Figure 6. Bioturbation at interface between impure carbonates (dark grey) and calcareous siltstones (light grey). Section 82B2 22.5 meters above section base. Member A unit 3 near Member A/Member B boundary.

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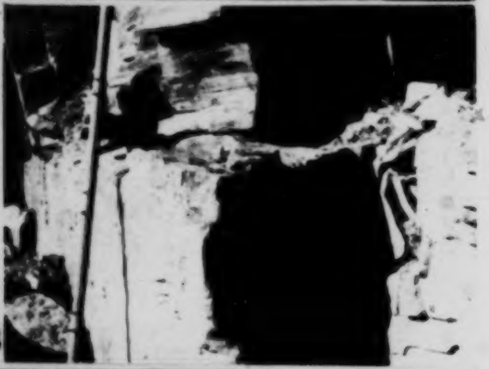

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PLATE 12

Figure 1. 82A2 94.5 meters above section base.
Figure 2. 82A 94.5 meters above section base.
Figure 3. 82A 94.5 meters above section base.
Figure 4. 82A 149.0 meters above section base.
Figure 5. 82A2
Figures 6, 7. 82A2
Figure 8. 82C1.83 30.5 meters above section base.

82A
94.5

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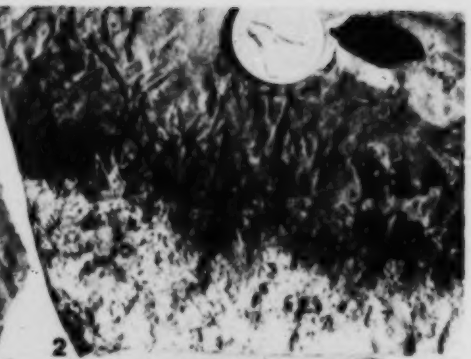

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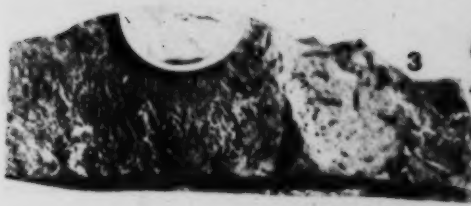

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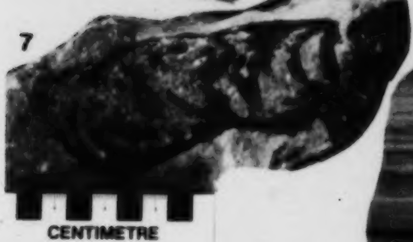
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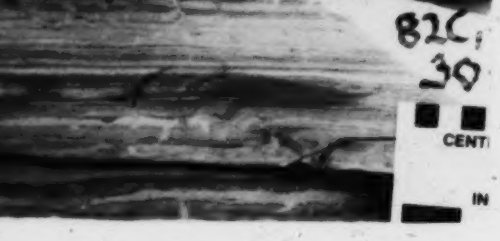
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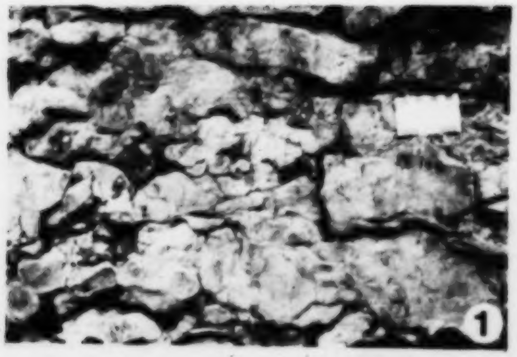
PLATE 13

Panorama of section 82C1/83. Reference section for unit 3 member A. Located on west shore of Goose Fiord, Ellesmere Island. Note increase in dark limestones over light dolostones/silty dolostones upsection. Section 82C1/83 as shown in text figure 5.13 only extends from base of the section (by man) to the horizon in the first thick interval of dark coloured limestones in the upper quarter of the exposed section (indicated by white arrows and dashed line). Lack of time negated complete measurement of the exposed section.

PLATE 14

Figure 1. Right angles to bedding in rubbly bedded impure bioclastic limestones. Note 'squeezed' shale matrix between lumps. Section 82C 14.6 meters above section base. Member B.
Figure 2. Oblique underside view of bedding showing elongate branching 'lumps' in rubbly impure limestones. Note 'squeezed' argillaceous matrix. Section 82C1 260 meters above section base. Member B.
Figure 3. Variably bioturbated planar laminated and very thin bedded calcareous sandy siltstones. Section 82B2 55.1 meters above section base. Member B. Note centimeter scale lower left center.
Figure 4. Alternating planar rubbly bedded bioclastic calcareous sandstone beds (prominent) and variably argillaceous rubbly bedded limestones with shale matrix (recessive). Bob Lee for scale. Section 82C1 252.0 meters above section base. Member B.
Figure 5. Cleaning-up rhythm from shales to decreasingly rubbly bedded, bioclastic, very calcareous sandstones within interval of abrupt interbedding of shale and rubbly bedded calcareous sandstones; see text figure 5.16. Section 82C 18.6 meters above section base. Member B. Pogo stick 1.5 meters long.
Figure 6. Cleaning-up /thickening-up rhythm of interbedded thin planar bedded siltstones and silty shales grading up to thicker bedded rubbly bioclastic sandstones. Bob Lee for scale. Section 82C 36.4 meters above section base. Member B top.
Figure 7. Chaotic bioclastic calcareous sandstone. Conical bioclasts are calcareous sponges. Others are colonial corals. A storm deposit. Section 82C 22.7 meters above section base. Member B.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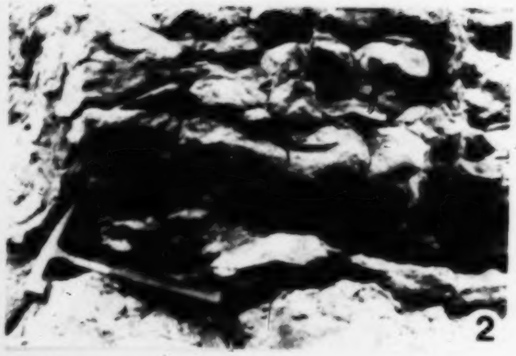
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PLATE 15

Figure 1. Cliff section exposed on east coast of North Kent Island. Looking north. Photo shows outcrop characteristics of Members A, B, C, and D. Section 81H measured along line of cliff edge. Approximately 400 meters of section shown.

Figure 2. Members A, B, and C exposed on west coast of North Kent Island at W.N.K. spot sample location. Approximately 200 meters of section exposed in cliff. Note three fold division of member B.

Figures 3, 4. Underside of bedding plane of rubbly bedded calcareous sandstones showing large horizontal traces typical of Member B.

Figure 3. Section 81E 261.0 meters above section base. Member F unit 3.

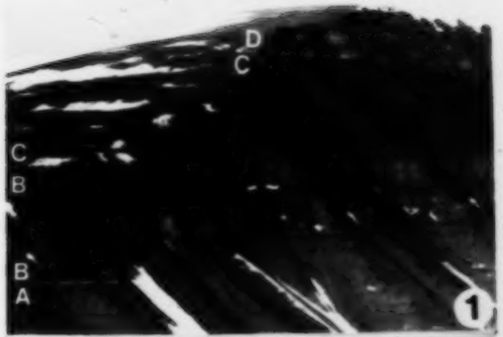
Figure 4. Section 82B4 loose block.

Figure 5. Right angles to bedding. Note furrowing (probably enhanced by compaction) produced by large scale horizontal bioturbation. Section 82C1 209.5 meters above section base. Member B.

Figure 6. Underside of loose slab. Horizontal furrows acted as traps for loose bioclastic material (**Elythyna**) valves. Section 82B4 loose.

Figure 7. Cliff exposure of unit 3 Member B showing typical planar layering of rubbly bedded calcareous sandstones separated by very thin recessive argillaceous beds. Section 81G 298 meters above section base.

Figure 8. Cleaning/thickening upward rhythm of rubbly bedded impure bioclastic sandy limestones. Color mottling due to differential dolomitization of matrix. Dark grey mottles are undolomitized. Note thin bedding in basal 30 centimeters of outcrop, and cleaning up (to darker purer limestones) at the top of the rhythm. Section 82C 7.5 meters above section base. Member B.



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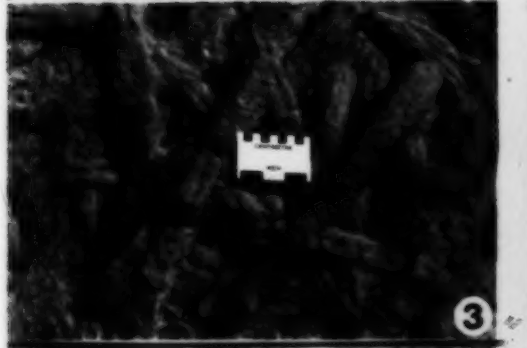
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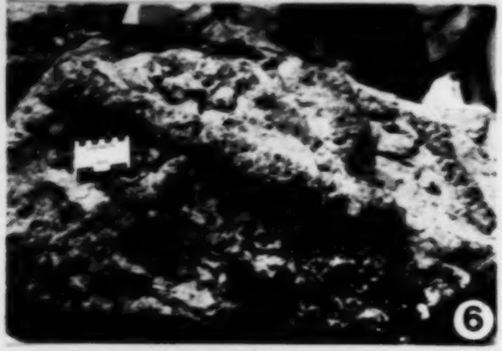
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PLATE 16

Figure 1. Compaction and injection of matrix (light grey) into overlying bed forming a mottled texture. Weathering of this forms a rubbly pattern. Section 82A2 126 meters above section base. Member B.

Figure 2. Rubbly bedded bioclastic argillaceous limestones with 'squeezed' shale matrix. Note calcite filled cracks in 'lumps' possibly caused by stress during compaction of lumps in a semi-lithified state. Section 82C 14.6 meters above section base. Member B.

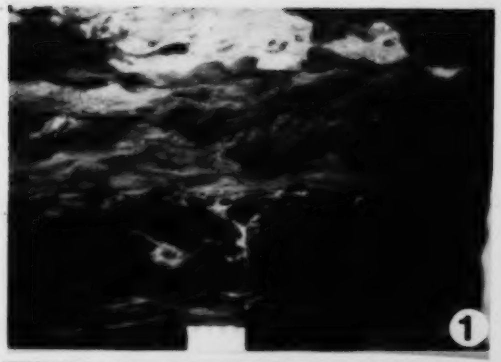
Figure 3. Trace fossil in micaceous, calcareous, fine grained sandstone. Section 83B loose. Member A unit 3/member B transition.

Figures 4, 5. Right angles to bedding (4) and bedding plane (5) views of paired vertical burrows in current laminated calcareous coarse siltstone. Section 82A3 30.1 meters above section base. Member B.

Figure 6. Bedding plane view of vertical and hortizontal bioturbation in rippled calcareous fine sandstone. Section 82A3 78.0 meters above section base. Member B.

Figure 7. Herringbone ripple cross lamination (right angles to bedding view) in calcareous sandstones. Formed by current reversal. Section 82A3 78.0 meters above section base. Member B.

Figure 8. Pre-storm and post storm sequence. Pre-storm winnowed deposits (**psw**) truncated by storm scour (**ss**) and overlain by post storm wane deposit (hummocky cross stratified) interval followed by megaripples which are in turn succeeded by fair weather rippled fine sandstones. Section 82A3 78.0 meters above section base. Member B.



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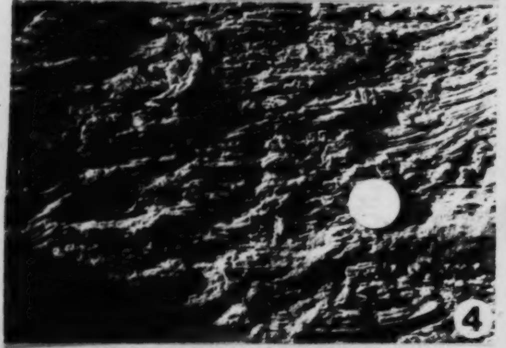

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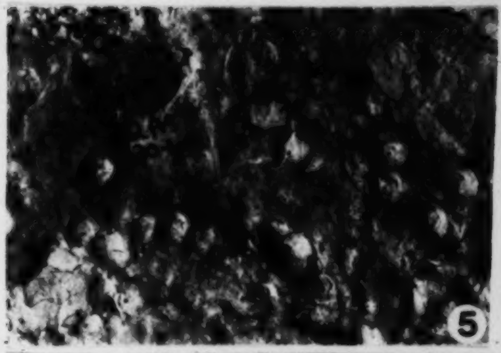

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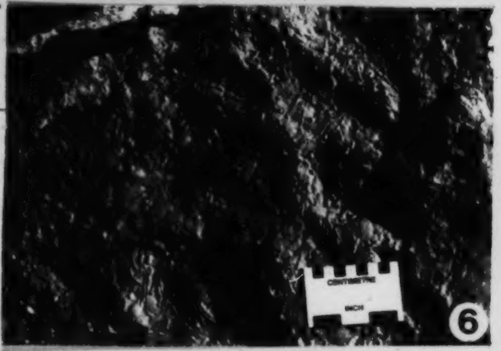

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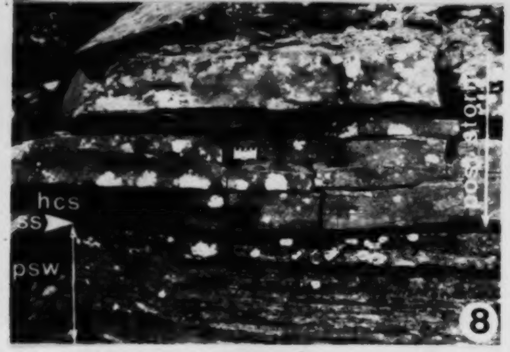

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poststorm
hcs
ss
psw

PLATE 17

Section 79GF (Goose Fiord, Ellesmere Island) showing the three fold division of Member B at this locality and west of Goose Fiord. Note the prominent cliff forming character of the member and the overall planar bedded nature. Arrow A indicates the position of large scale cross-stratification within a planar bedded interval. Arrow B indicates a channel margin near the base of unit 3 (see cross-stratification immediately above arrow). The C arrows point to lateral thinning of the light colored unit below a dark marker horizon. Cliff height to base of photograph is 80 meters.

UNIT 3
UNIT 2
UNIT 1

PLATE 18 (and overlay)

Panorama of Section 83A showing upper portion of Member B, all of Member C and the lower portion of Member D. Note variation in sedimentary style in Member C. Depositional environments are indicated on the overlay. White arrow points to man for scale.

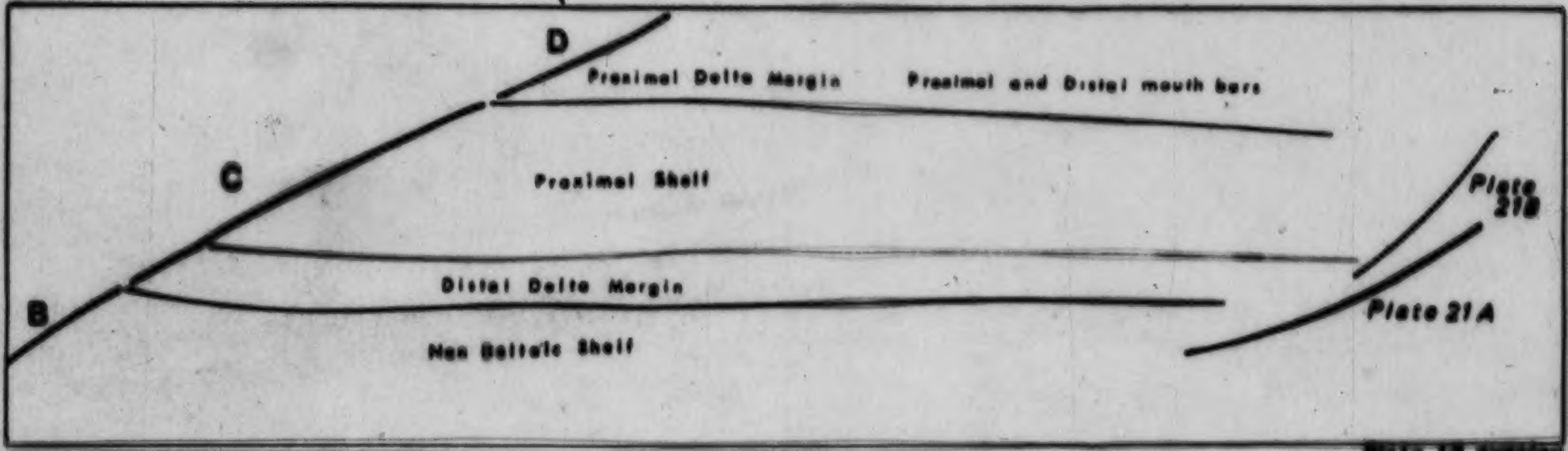

D
Proximal Delta Margin
Proximal and Distal mouth bars
C
Proximal Shelf
Plate 21B
Distal Delta Margin
B
Plate 21A
Non Deltaic Shelf

Plate 18 overlay

Distal mouth bars
218

Plate 18 overlay

PLATE 19

Figures 1, 2. Coral biostrome. 82B Spot Sample 1. Lower beds of member C near Section 82B2.

Figure 3. Slightly rubbly bedded bioclastic calcareous sandstone at top of coarsening/cleaning-up rhythm. Section 83A 29.8 meters above section base. Member C.

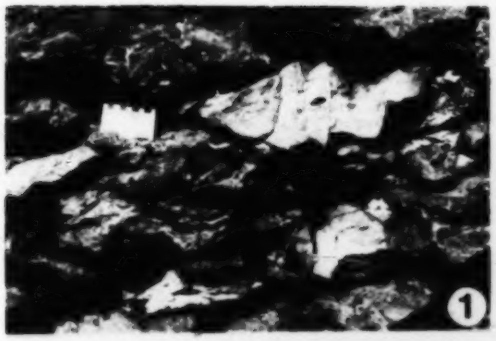
Figure 4. Bioclastic calcareous sandstone at top of coarsening up rhythm. Note distinct coral rich horizons in massive to current laminated sandstone matrix. These horizons possibly indicate relatively deposition-free periods during the overall deposition of the rhythm. Section 82C 53.0 meters above section base. Member C.

Figure 5. Sharp based massive and current laminated calcareous bioclastic sandstone at the top of a cleaning/coarsening-up rhythm. Uppermost portion very coral rich (beside and above scale). Sandstone possibly a storm deposit later colonised by a rich coral biota during a relatively deposition-free period. Section 83A 49.5 meters above section base. Member C. See text figure 5.18.

Figure 6. Right angles to bedding. Coquinoid ungraded bioclastic calcareous sandstone at the top of a coarsening-up rhythm. Note lack of grading and the commonly articulated nature of the Elythynid brachiopods. Storm deposit. Section 83A 65.9 meters above section base. Member C.

Figure 7. Right angles to bedding. Bioturbated wavy, lenticular and thinly interbedded fine sandstones and silty shales. Near top of fining-up channel fill sequence. Section 83A 53.5 meters above section base. Member C.

Figure 8. Sparsely bioclastic calcareous sandstones showing planar cross-bedding and wavy cross-stratified layers overlain by ripple laminated sandstone. ?Shoreface. Section 83A 61.5 meters above section base. Member C. Note hammer for scale at right center.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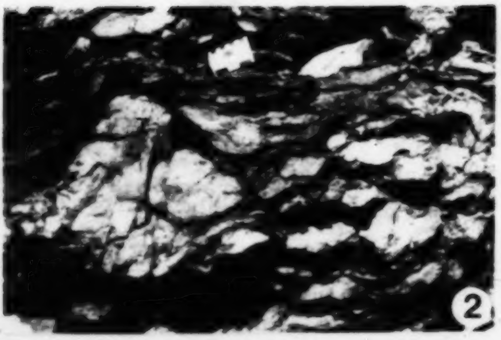
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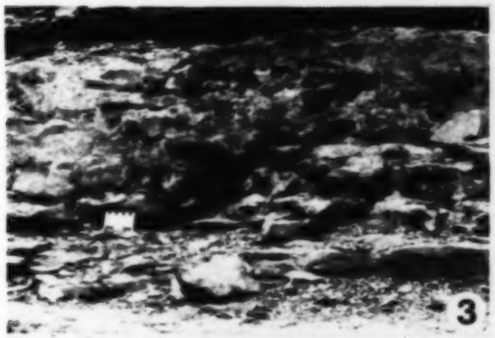
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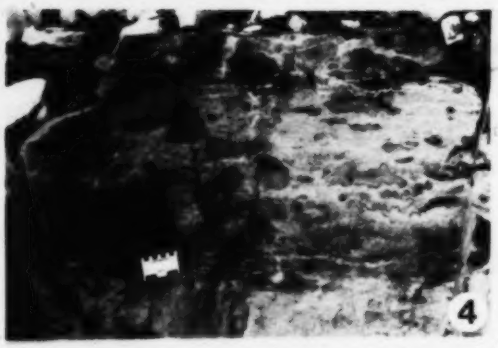
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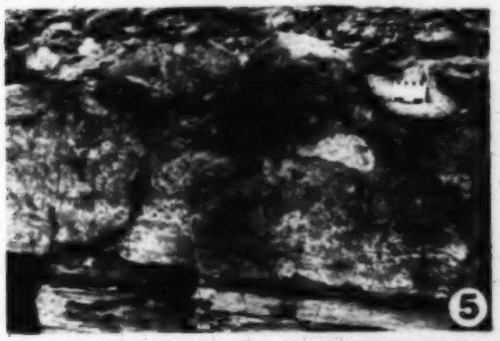
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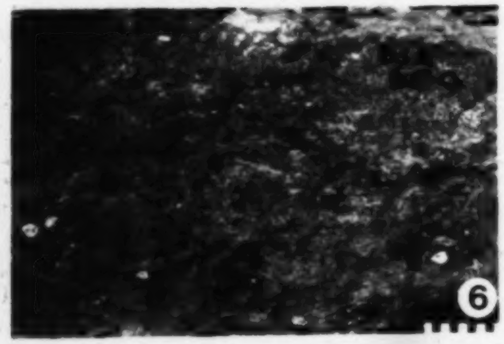
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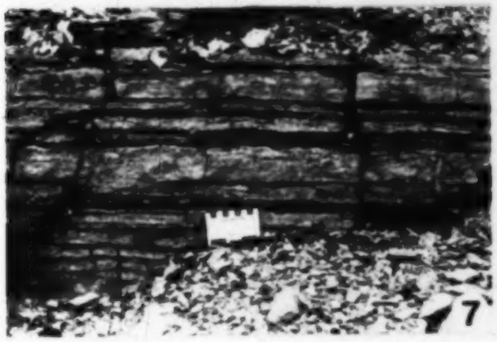
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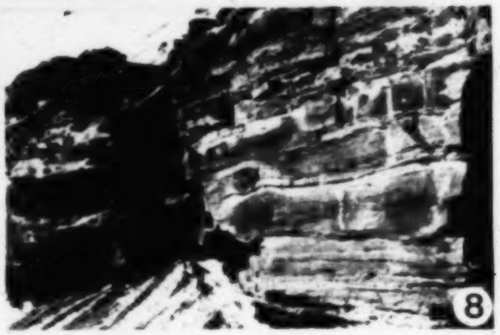
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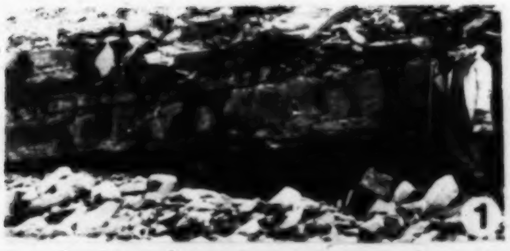
PLATE 20

Figure 1. Coarsening-up/cleaning-up rhythm of shales abruptly grading to calcareous sandstones. Observe massive nature of the lower sandstone and cross-bedding further up unit. Lower massive sand may represent storm deposition, whereas cross bedded upper portion represents storm wane and fair weather reworking. Section 82C 55.0 meters above section base. Member C.
Figure 2. Planar and cross-bedded sandstones intercalated with thin flaser and lenticular bedded argillaceous intervals. Upper portion of cleaning-up rhythm. Note small sandstone bar form. Member 82C 61.0 meters above section base. Member C.
Figure 3. Edge of large channel behind man shown in Plate 21 figure A. Filled with argillaceous siltstone. Note truncation of lower channel fill by a subsequent erosion and fill event. Bob Lee for scale. Section 83A 23.0 meters above section base. Member C.
Figure 4. Massive and rippled sandstone lenses in wavy laminated argillaceous siltstone. Large scale channeled interval Section 83A 24.0 meters above section base. Member C. See Plate 21.
Figure 5. Cross-bedded 'sheet-like' bioclastic calcareous sandstone above channeled interval. Section 83A 27.7 meters above section base. Member C.
Figure 6. Sandstone in channelled interval showing convolute lamination due to ?dewatering. Section 83A 25.0 meters above section base. Member C.
Figure 7. Lensoid sandstone within channelled sequence showing loaded base into underlying argillaceous siltstone. Note current lineation on loose blocks. Section 83A 19.0 meters above section base. Member C.
Figure 8. Vertical burrowing in upper part of lensoid sandstone in channeled interval. Section 83A 35.0 meters above section base. Member C.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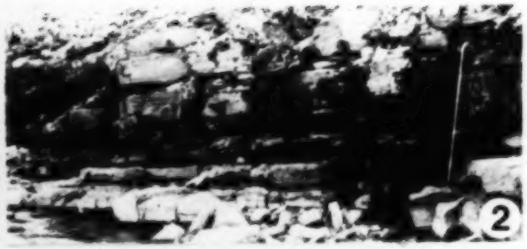
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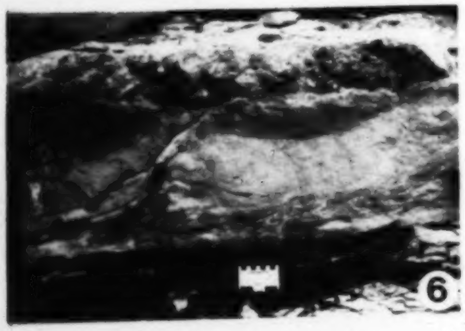
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PLATE 21
(in rear fold)

A. Photomosaic of the lower portion of section 83A (see Plate 18 for location). Arrow points to man for scale. Note interval of channeling and cross bedding of delta margin/distributary channel origin between planar bedded coarsening up rhythms of shallow shelf origin.
B. Photomosaic of upper portion of section 83A. Open arrow points to Bob Lee for scale. Solid arrows depict an interval with large scale cross stratification of ?marine bar origin. Lithologies otherwise planar-bedded and arranged in coarsening-up sequences (see text figure 6.18). Note channel and associated pinchouts behind and to the viewer's right of man.

PLATE 22

Cliff section of members B, C, and D in section 82B4 head-of-valley exposure. Member C in this locality contains more non-calcareous sandstone beds than it does at the reference section (83A). This may indicate greater proximity to a clastic source for this section than for Section 83A. Note cross-bedding in light colored non-calcareous sandstones and large scale cross-bedding and channelling in darker calcareous sandstones.

D
C
C
B

PLATE 23

Figure 1. Edge of large ?distributary/tidal? channel fill capped by planar flagged and low angle cross laminated unfossiliferous non-calcareous sandstone. Channel sequence abruptly overlain by rubbly bedded bioclastic argillaceous sandstones. Section 82C1 340.0 meters above section base. Member C.

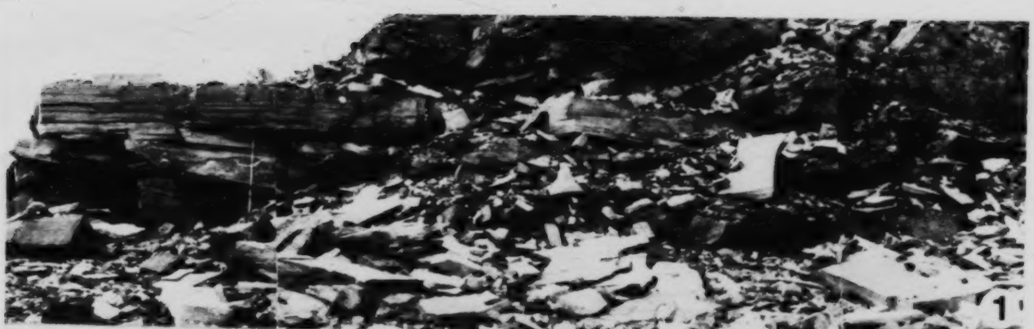
Figure 2. Cross-section through large scale trough cross-stratified non-calcareous sandstones. Proximal mouth bar. Spot Sample 82B SS9. Member D. On strike from Section 82B2.

Figure 3. Current-bedded calcareous sparsely bioclastic sandstone. Note strange cementation fabric (light and dark mottling). Section 82B2 173.0 meters above section base. Lowest part of Member D.

Figure 4. Coarsening/cleaning-up rhythm of silty shales to variably lenticular, flaser bedded and cross-stratified, thin-bedded sandstones (discontinuous along strike) within silty shale. This interval represents a minor 'fining-up' rhythm within a larger coarsening-up trend due to small scale scour and fill. Section 82C 86.6 meters above section base. Member B.

Figure 5. Massive sandstone channel plug in planar flagged sandstones. On strike with Section 82C 86.6 meters above section base. Member D. Hammer at centre base of channel for scale.

Figure 6. Multiple channelling within planar and cross-stratified unfossiliferous sandstones (light) and variably fossiliferous (*Atrypa sp.*) dark siltstones and silty shales. ?Tidal current origin. Outcrop in isolated bluff upsection from top of Section 82C1. Member D.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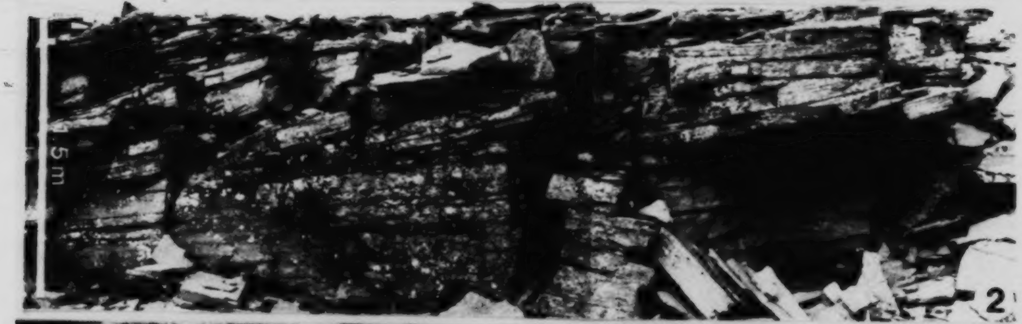

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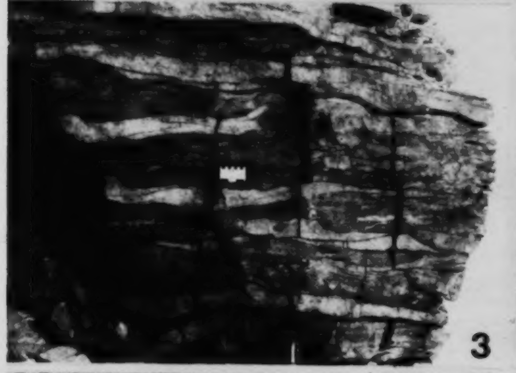
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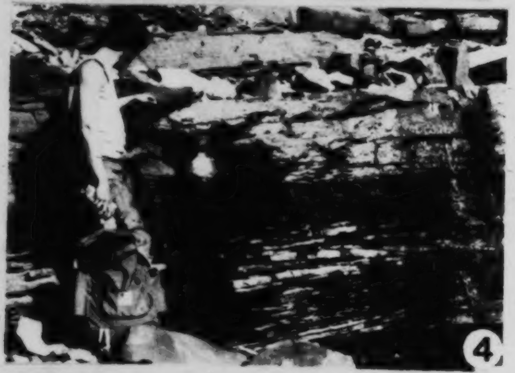
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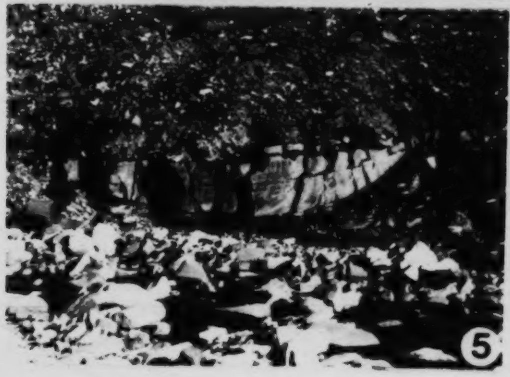
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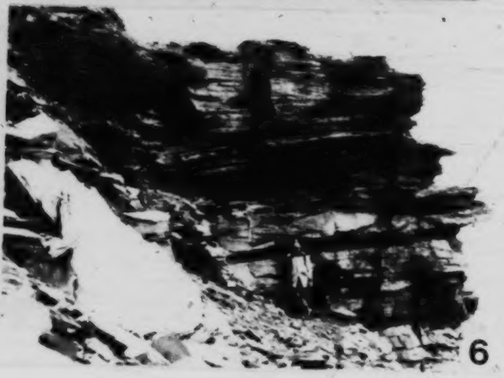
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PLATE 24

Figure 1. Ripple cross-laminated (occasionally trough cross-stratified) bioclastic shelf-process-dominated sandstones (**s**) by Bob Lee overlain by bioturbated argillaceous siltstones of distal mouth bar origin (**db**). This overlain erosively by non-bioclastic, current-lineated and trough cross-stratified, fine grained sandstones of proximal mouth bar origin (**pb**). Along strike from section 83A 70.0 meters above section base. Member D.

Figure 2. Along strike and slightly up section from figure 1. Alternation of recessive, argillaceous distal bar deposits (**db**) with prominent proximal bar sandstones(**pb**) . Note color and bedding variation in pb sandstones. Light-colored trough cross-stratified sandstones have not been reworked by shelf processes. Darker rippled and massive calcareous sandstones are proximal bar deposits which have undergone significant reworking by shelf processes. On strike from Section 83A 75.0 meters above section base. Member D. Hammer at center for scale.

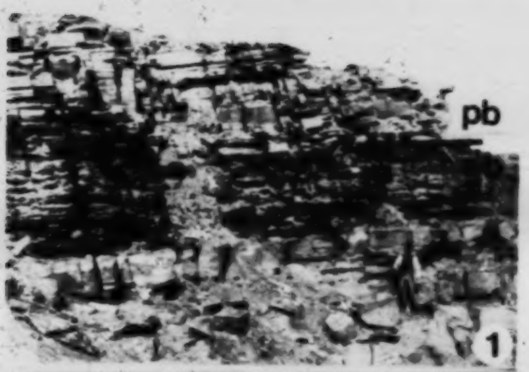
Figure 3. Slumping at base of proximal bar sandstone. Due to compaction of undewatered substrate. Section 83A 76.0 meters above section base. Member D.

Figure 4. Unidirectional trough cross-stratification in proximal mouth bar deposit. Section 82C 78.0 meters above section base. Member D. Note hammer at center for scale.

Figure 5. As for figure 3. Note erosion surface and slight hummocking to uppermost beds.

Figure 6. Loading structures in sandstones of proximal mouth bar origin. Indicative of rapid deposition on undewatered substrates. Section 83A 95.0 meters above section base. Member D.

Figure 7. Erosive contact between coquinoid sandstone (above scale) and trough cross-stratified, non-bioclastic sandstones. Section 83A 93.0 meters above section base. Member D.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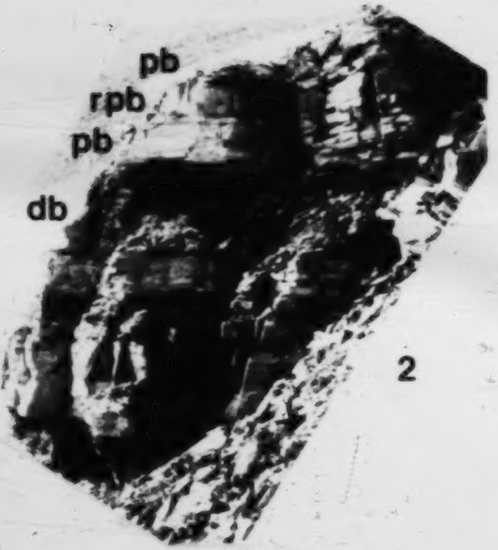
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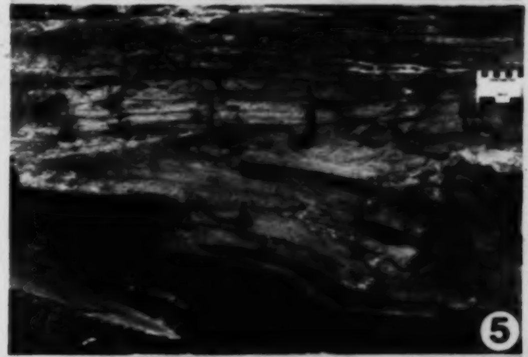
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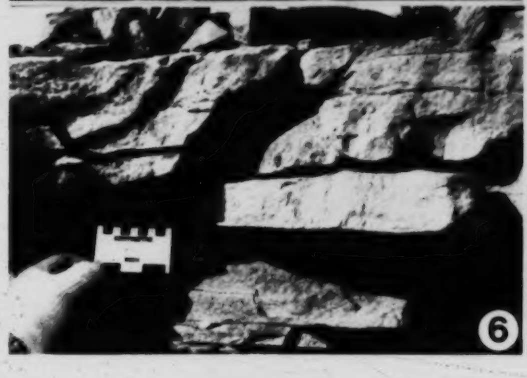
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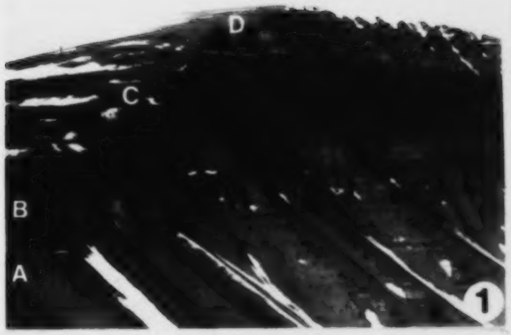
PLATE 25

Overlapping views of cliff section of Bird Fiord Formation exposed on east coast of North Kent Island. Figures 1-8 (plus 1, 2 of Plate 26) progressing northward. Note lateral continuity of thin sheet sandstones of Member C; also the northward break-up of the lower sand horizon in Member D. This interdigitates northward with darker calcareous sandstones and siltstones (see figures 5, 6 and 7). This is indicative of a southerly provenance for this sandstone unit. Interpreted as reworked delta margin sands grading northward into a shallow shelf setting.



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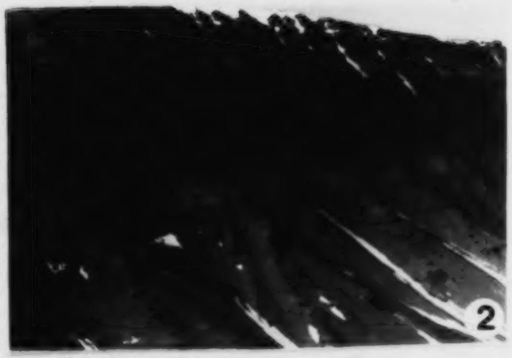

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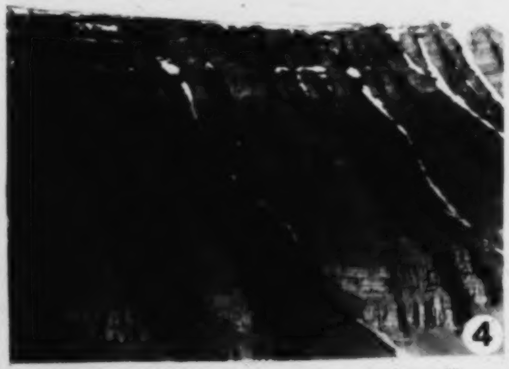

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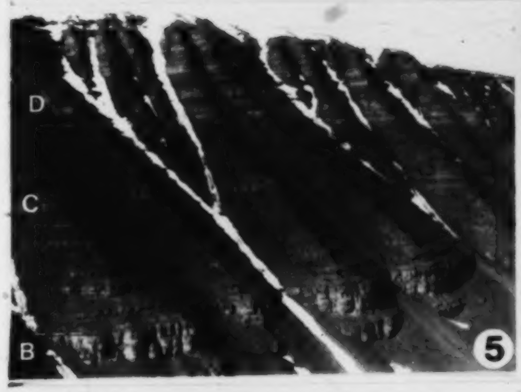

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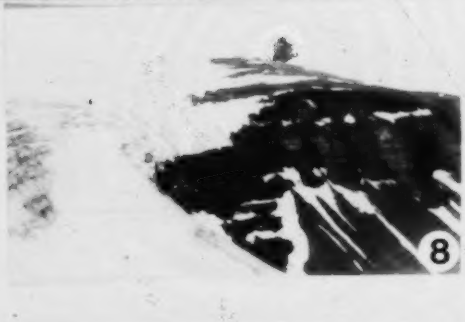

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PLATE 26

Figures 1, 2. Continuation of cliff section as anotated for Plate 25.

Figure 3. Trough cross-bedded, planar cross-bedded and planar flagged non-calcareous sandstones. ?Delta margin origin. Section 81H 330 meters above section base. Member D.

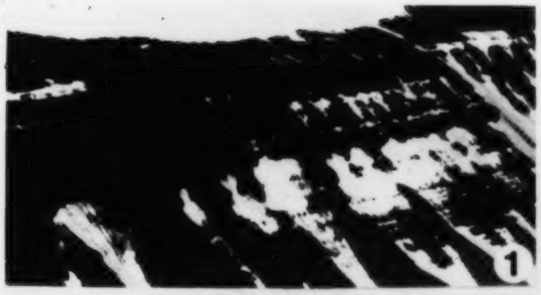
Figure 4. Planar flagged and very low angle planar cross-stratified, non-calcareous sandstones. ?Beach origin. Section 81H 362 meters above section base. Member D.

Figure 5. Mudcracking? in intraclastic slightly fossiliferous, fine grained sandstone. Section 81H Member D. Loose.

Figure 6. Interference rippling. Fine grained sandstone. Section 81H Member D. Loose.

Figure 7. West coast of North Kent Island looking north (upsection) at uppermost Bird Fiord Formation, Strathcona Fiord Formation(**StF**), and Hecla Bay Formation (**HB**) . Note sedimentological changes within the Bird Fiord Formation between members C and D. The member boundary is drawn at the first thick (>10 meters thick) non calcareous sandstone interval. Observe large scale pinchouts (northward) of non-calcareous sandstones in Member D indicating a southerly source. Compare to panorama in Plate 25.

Figure 8. Trough cross-stratified non-calcareous unfossiliferous sandstones. Section 81H 350 meters above section base. Member D.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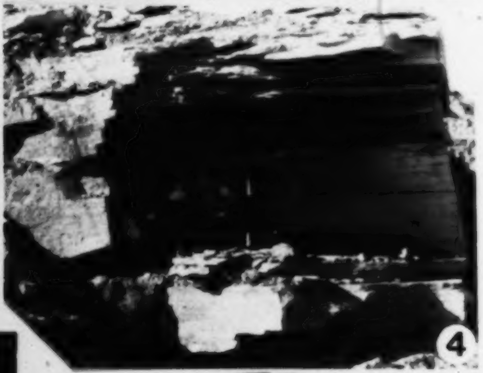
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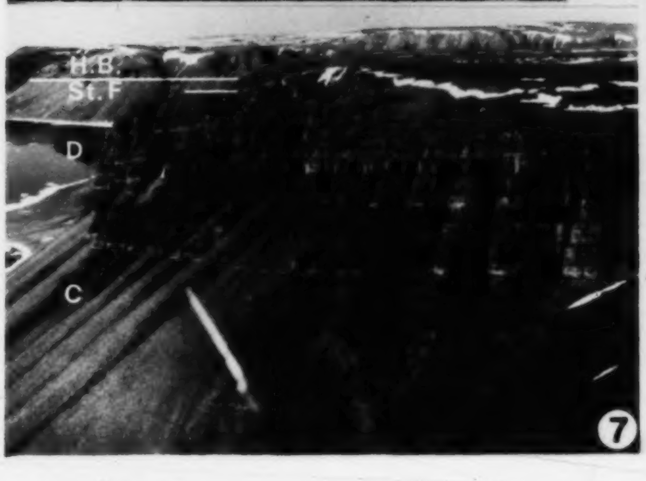

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PLATE 27

Figure 1. En echelon megaripples (dunes) overlying massive sandstones at base of channel fill sequence. Section 83GRF2 9.0 meters above section base. Member E. Note centimeter scale at left center.

Figure 2. Alternating massive-bedded and trough cross-stratified sandstones. Section 83GRF2 35.0 meters above section base. Member E.

Figure 3. Shale at base represents top of underlying fining-up channel-fill sequence. This is erosively overlain by massive and trough cross stratified sandstones of the subsequent channel. Section 83GRF2 30.0 meters above section base. Member E.

Figure 4. Multiple channel fills. Base of section 83GRF2. Pogo stick 1.5 meters long. Member E.

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PLATE 28

Figure 1. Close-up of channel scour contact lined with shale rip-up clasts. Base of section 83GRF2. Member E.
Figure 2. Remnant carbonaceous shale pod between channel sandstones. Section 83GRF2 50.0 meters above section base. Member E.
Figure 3. Right angles to bedding. Fining-up sequence from silty sandstones at the base to chaotically interlaminated (due to loading?) siltstones and silty shales. Section 83GRF2 29.0 meters above section base. Member E.
Figure 4. Minor scouring and stacked cross stratification in multiple channel sequence. Section 83GRF2 14.0 meters above section base. Member E.

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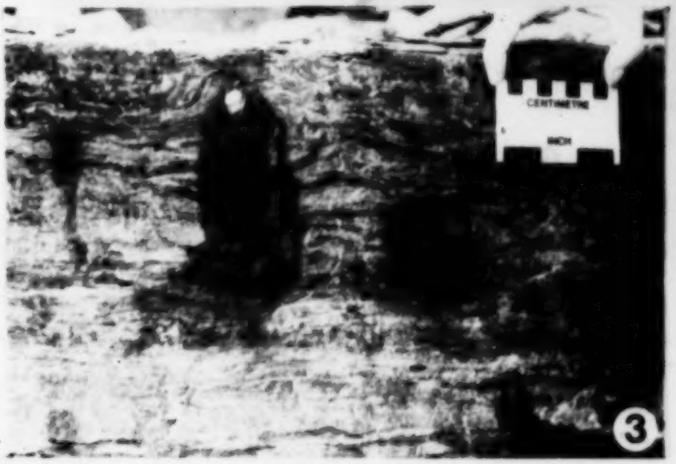
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PLATE 29

Figure 1. Coarsening/cleaning-up rhythm. Rubbly-bedded, silty shales at man's feet grade up into bioclastic rubbly-bedded, calcareous argillaceous siltstone. Note overturned coral heads (storm activity). This overlain by current-bedded, non-rubbly calcareous siltstone. Section 81E 137.0 meters above section base. Member F unit 1.
Figure 2. Section through cryptalgal mound showing wavy and discontinuous interlaminae of light and dark brown dolomitic siltstones. Section 81E 245.0 meters above section base. Member F unit 2.
Figure 3. Section at right angles to bedding showing three adjacent cryptalgal mounds and associated irregular lamination. Section 81E 245.0 meters above section base. Member F unit 2.
Figure 4. Bedding plane view of current-oriented cryptalgal mounds. Section 81E 245.0 meters above section base. Member F unit 2.
Figure 5. Thickening/cleaning-up rhythm of argillaceous siltstones to rubbly-bedded, calcareous sandstones. Section 81E 351.5-353.0 meters above section base. Section 81E Member F unit 3. Canadian quarter for scale.
Figure 6. Repetitive cleaning-up rhythms of silty shale to siltstone. Section 81E 249.0-260.0 meters above section base. Section 81E Member F unit 3. Cliff height approximately 25 meters.
Figure 7. Bedding plane exposure of rust colored sandstone with gypsum rosette pseudomorphs. Basal Strathcona Fiord Formation approximately 30.0 meters above the top of Section 79SF (Sor Fiord).

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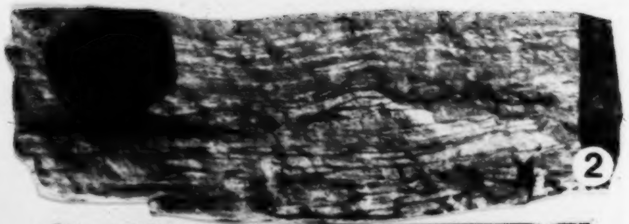

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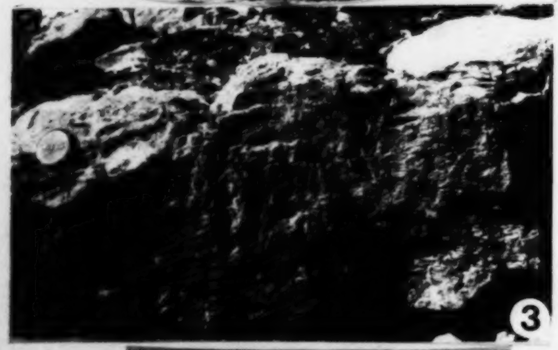

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PLATE 30

Figure 1. Thinly (20 centimeters) planar-bedded, bioclastic, rubbly, impure limestone. Note 'thickening-up/cleaning-up' trend. Section 81AX 30.0 meters above section base. Member C unit 1.

Figure 2. Weathered outcrop of trough cross-stratified and wavy-laminated, coquinoid, calcareous sandstone. Bar sandstone facies. Section 81A 340.0 meters above section base. Member C unit 2.

Figure 3. Shallow channel fill with rippled and trough cross stratified coquinoid calcareous sandstone. Bar sand facies. Section 81AX 105.0 meters above section base. Member C unit 2.

Figure 4. Small scale channel cut-and-fill underlain and overlain by planar flagged ripple cross-laminated sandstone. Bar sand facies. Section 81AX 150.0 meters above section base. Member C unit 2.

Figure 5. Trough cross-stratified interval (below hammer) overlain by ripple-laminated sandstone. Upper part of coarsening up rhythm. Section 81AX 150.0 meters above section base. Member C unit 2.

Figure 6. Bioturbated and ripple cross-laminated calcareous sandstones showing herringbone cross-lamination (see arrowed layer). Upper portion of coarsening-up rhythm. Bar sand facies. Section 81AX 150 meters above section base. Member C unit 2.

Figures 7, 8, 9. Rich trace fossils associated with bar sand facies.

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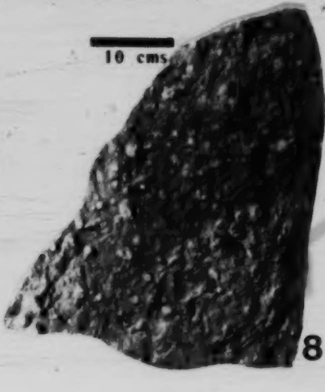

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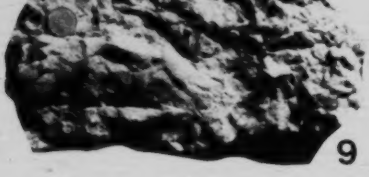
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PLATE 31

Figure 1. Trough cross stratification in coquinoid calcareous sandstones. Migrating marine bar. Section 81B 310.0 meters above section base. Member C unit 2.

Figure 2. Wavy laminated and herringbone cross stratified (below quarter) non-calcareous sandstones. Sandstones in upper part of photograph variably ripple laminated or totally bioturbated. Upper portion of coarsening upward rhythm. Bar sandstone facies. Section 81AX 150.0 meters above section base. Member C unit 2.

Figure 3. Large scale trough cross stratified bioclastic sandstones within lower portion of sand unit capping a coarsening-upward sequence. Gradationally overlain by thin bedded small scale trough cross stratified and cross laminated, bioturbated calcareous bioclastic sandstones as in figure 4. Storm deposition of sand sheet -or equivalent to central bar facies of Tillman and Martinnsen (1984) though position in rhythm argues against a bar crest position. Section 81D 330 meters above section base. Member C unit 2.

Figure 4. Thin bedded trough cross-stratified, ripple crosslaminated bioclastic sandstones with minor channel scour-and-fill. Locally sandstones are vertically and horizontally burrowed. Sand capping coarsening upward rhythm. Very similar sandstones to these cap the sandstones shown in figure 3. Section 81A 390 meters above section base. Member C unit 2.

Figure 5. Swales and hummocky cross lamination (?HCS) within bioclastic sandstones. Top of small scale coarsening upward rhythm. Section 81D 284.0 meters above section base. Member C unit 2?

Figure 6. Truncated small channel fill sequence within non-calcareous, cross stratified, fine grained sandstones. Section 81D 480.0 meters above section base. Member D unit 2. Fluvial?

Figure 7. Looking eastward up section at the top of section 81D. Obvious sharp contact in cut bank between light grey-buff non-calcareous trough cross-stratified and channelled sandstones at the top of the Bird Fiord Formation and red siltstones and fine sandstones of the Strathcona Fiord Formation.

Figure 8. Linear ripple marks on bedding surfaces of loose block. Capping sandstone in coarsening-up rhythm. Section 81AX 153.0 meters above section base. Member C unit 2 (see figure 2 this plate).

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PLATE 32

Overlapping photographs of cliff section 80X, Half Moon Bay, Dundee Bight, Bathurst Island. North is to the left. Cliff height at maximum is 215 meters.
Starting at right: Note obvious contact between recessive siltstones and calcareous shales (referred to the Eids Formation by Kerr, 1974 and in Map 1350A; Embry and Klovan, 1976; and in this thesis) with rubbly-bedded impure carbonates (attributed to the Blue Fiord Formation by Kerr, 1974; limestone member of the Disappointment Bay Formation according to Smith, 1984; Bird Fiord Formation carbonate equivalent, this thesis). Bird Fiord Formation member C unit 1 is characterized by repetitive large scale coarsening-up rhythms. The thick recessive shale-dominated basal intervals of the large scale rhythms in unit 1 are lacking in member C unit 2.

Member D is distinguished from member C by the occurrence of sandstone intervals 10-15 m. thick. Member D unit 1 consists of these sandstone intervals interspersed with similar small scale coarsening-up rhythms as found in member C unit 2. Member D unit 2 is characterized by large channel cut and fill, cross stratified non-calcareous sandstones and a general absence of coarsening-up rhythms (see Plate 36 figure 3). The contact with the Hecla Bay Formation is taken at the base of a crossbedded white and yellow weathering sandstone in excess of 30 meters thick.

This cliff section represents an outer shelf (?slope) to fluvial transition: Eids Formation - slope; Bird Fiord Formation carbonate equivalent - carbonate outer shelf; Member C unit 1 - clastic outer/distal shelf; Member C unit 2 - middle/proximal shelf; Member D unit 1 inner/proximal shelf with bars and barrier islands; Member D unit 2 - delta margin distributaries and interdistributary bays; Lower Hecla Bay Formation - delta plain.
Photographs courtesy of Dr. A. Embry.

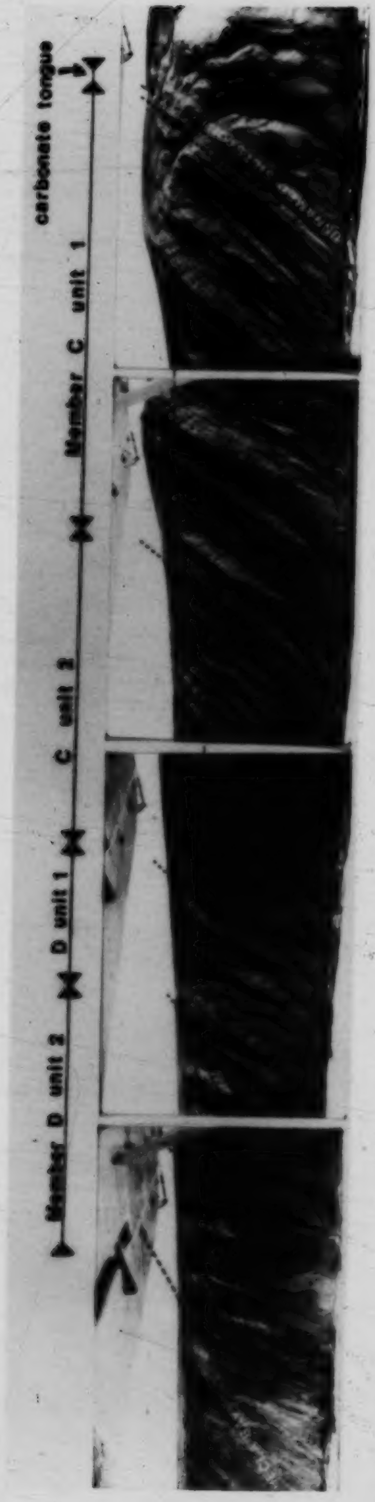
Member D unit 2
D unit 1
C unit 2
Member C unit 1
carbonate tongue

PLATE 33

Figure 1. Cliff exposure of section 80XI, Stuart Bay, Bathurst Island. Note repetitive large scale (approximately 40 meters thick) coarsening-up rhythms. Section 80XI measured 1 kilometer north of this cliff (to the left). Cliff height 180 meters

Figure 2. Recessive shale-dominated interval in basal portion of large scale coarsening-up rhythm. Note interspersed sharply bounded calcareous sandstones of ?storm origin (see text figure 6.3). Section 80XI 250-276 meters above section base. Member C unit 1. Paul Mortensen for scale.

Figure 3. Upper prominent weathering sandstone dominated portion of large scale coarsening-up rhythm. Note inhomogeneity of sandstones and the presence of small scale (1.5 meters thick) cleaning-up rhythms. Section 80XI 79.6-86.0 meters above section base. Member C unit 1.

Figure 4. Prominent bioclastic sandstone in upper portion of large scale coarsening-up sequence. Rubbly nature due to bioturbation and ripple lamination. Section 80XI 243-247 meters above section base. Member C unit 1. Note pack at bottom for scale.

Figure 5. Close up of sandstone in upper portion of large scale coarsening-up rhythm. Note intense bioturbation and vague hummocking of laminae. Section 80XI 237.25 meters above section base. Member C unit 1.

Figure 6. Multiple small scale current scour and fill in planar laminated and lenticular-bedded interlayered siltstones and argillaceous siltstones. Basal portion of small scale coarsening-up rhythm in upper part of large scale coarsening-up rhythm. Section 80XI Member C unit 1.

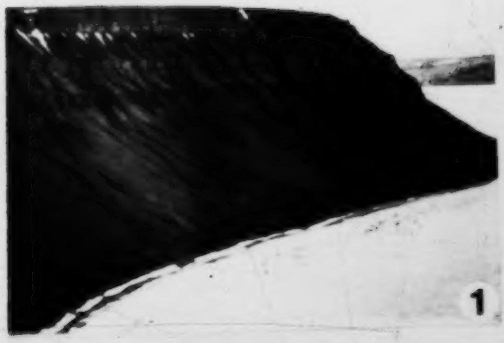
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PLATE 34

Figure 1. Variable capping sandstone to small scale coarsening up rhythm. Section 80I 652.0 meters above section base. Member C unit 2. Hammer for scale in left center.
Figure 2. Capping sandstone to small scale coarsening-up rhythm. Note massive basal bed overlain by trough cross-stratified and wavy laminated sandstones. May represent storm and post storm deposition. Section 80XII 302.0 meters above section base. Member C unit 2.
Figure 3. Close-up of scoured and current bedded sandstone with thin shelly lags. Note vuggy texture of sandstone in upper portion of figure. Capping sandstones of small scale coarsening-up sequence. ?Storm deposition. Section 80XII 209.0 m. above section base. Member C unit 1.
Figure 4. Scoured and current bedded bioclastic calcareous sandstones. Upper part of small scale coarsening-up rhythm. Section 80X 483.0 meters above section base. Member C unit 2.
Figure 5. Complete section through upper portion of small scale cleaning-up rhythm. Lenticular, wavy and flaser bedded fine sandstones and siltstones at base (recessive, dark) gradationally overlain by prominent cross-bedded sandstones to top of hammer handle. Smaller coarsening-up rhythm above this. Section 80I 652.0 meters above section base. Member C unit 2.
Figure 6. Sharp contact between capping sandstone of preceeding rhythm and basal shale of overlying rhythm. Shales are bioturbated and contain lenses of siltstone and fine sandstone (increasing up section) rich in brachiopods (*Atrypa* sp., *Schizophoria* sp.). Capping sandstones of rhythm on skyline. Section 80I meters above section base. Member C unit 2.
Figure 7. Planar flagged current lineated very fine grained sandstone in upper portion of cleaning-up rhythm. Section 80I Member C unit 2.

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PLATE 35

Figure 1. Cliff exposure at section 80XIII, south end of Dundee Bight, Bathurst Island. Note large scale cleaning/coarsening-up rhythms in member C unit 1. Shales and siltstones forming recessive slope beneath lowest prominent bed variably assigned by previous authors to the Eids and Cape De Bray formations. Herein assigned to the Cape De Bray Formation. Cliff height 180 meters.
Figure 2. Small scale coarsening-up rhythms. Basal shale grading to argillaceous siltstone, abruptly capped by prominent sandstones. Upper part of large scale coarsening-up rhythm. Section 80XII 149.0-151.0 meters above section base. Member C unit 1. Note centimeters scale at bottom center.
Figure 3. Repetitive small scale coarsening-up rhythms. Note sharp upper and lower contacts of sandstone beds. Section 80X 370.0 meters above section base. Member C unit 2. Paul Mortensen for scale.
Figure 4. Uppermost sandstone of small scale coarsening-up rhythm. Note bioturbated planar flagged sandstone at base overlain by cross-stratified (swaley?) sandstones. Section 80I 768.0 meters above section base. Member C unit 2.
Figure 5. Bioturbated, planar and wavy-laminated, argillaceous siltstones with minor current scour and fill. Upper portion of large scale coarsening-up rhythm. Section 80XIII 38.5 m above section base. Member C unit 1.
Figure 6. Large scale herringbone cross-stratification within a thick non-calcareous sandstone interval. ?Tidal channel origin. Section 80XII 620.0 meters above section base. Member D unit 1.

Bird c1
Cape De Bray

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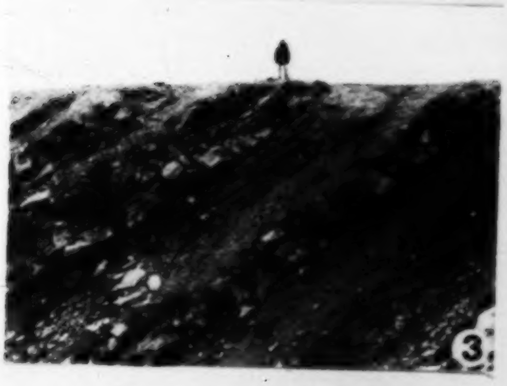

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PLATE 36

Figure 1. Thick (>10 meters) planar and low angle cross bedded unfossiliferous non-calcareous sandstone abruptly overlying coarsening-up argillaceous siltstones. ?Prograding offshore bar or barrier bar origin. Section 80X 667-683 meters above section base. Paul Mortensen for scale (= 2 meters).

Figure 2. Non calcareous low angle large scale planar cross bedded fine grained sandstones. ?Barrier bar origin. Section 80XII 528-536 meters above section base. Member D unit 1. Paul Mortensen for scale.

Figure 3. Cliff exposure of interval 804-834 meters above of section 80X. Note large scale channelling and channel fill. Distributary channel fill overlain by interdistributary bay fill and overbank deposits. Arrow points to man for scale (top right). Member D unit 2.

Figure 4. Multiple channel cut and fill sequences in non-calcareous, unfossiliferous, fine grained sandstones. Braided fluvial origin. Section 80X 995.0 meters above section base. Hecla Bay Formation.

Figure 5. Planar cross-bedding in unfossiliferous non-calcareous sandstones within silty shales. Section 80IB. 22.0 meters above section base. Hecla Bay Formation.

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PLATE 37

Brachiopods from the Bird Fiord Formation. All illustrations x1.

Figures 1-6: *Anatrypa (Variatrypa)* cf. *arctica* (Warren). Pedicle, lateral and brachial views. 1-3 from 1980 Loc VIIB; 4-4 from Section 1981A 224 m.
Figures 7-9; 13-18: *Spinatrypa (S.) borealis* Warren. Pedicle, lateral and brachial views. 7-9 from Section 1980 XII 204.8 m. 13-15 from Section 1980 XI 0.0 m. 16-18 from Section 81A 138.5 m.
Figures 10-12; 19-24: *Atrypa* sp. 10-12, 22-24 from Section 81B top Bird Fiord Formation carbonate equivalent. 19-21 from Section 1982C1 297.0 m.
Figures 25-36: *Cupularostrum repetitor* Johnson & Perry. Pedicle, lateral and brachial views. 25-30 from Section 1980 I 673.5 m. 31-35 from 1980 Loc II-F1.
Figures 37-42: 'Rhynchonellid' sp. Pedicle, lateral and brachial views. Section 1982 B Spot sample 1.
Figures 43-47: *Cupularostrum*? sp. Pedicle, lateral and brachial views. Section 1981 B top Bird Fiord Formation carbonate equivalent.
Figures 48-54: *Costacranaena marlenae* Johnson & Perry. Pedicle, lateral and brachial views. 49-51 from Section 1980 XII 264.3 m. 52-54 from Section 1981 A 224.0 m.

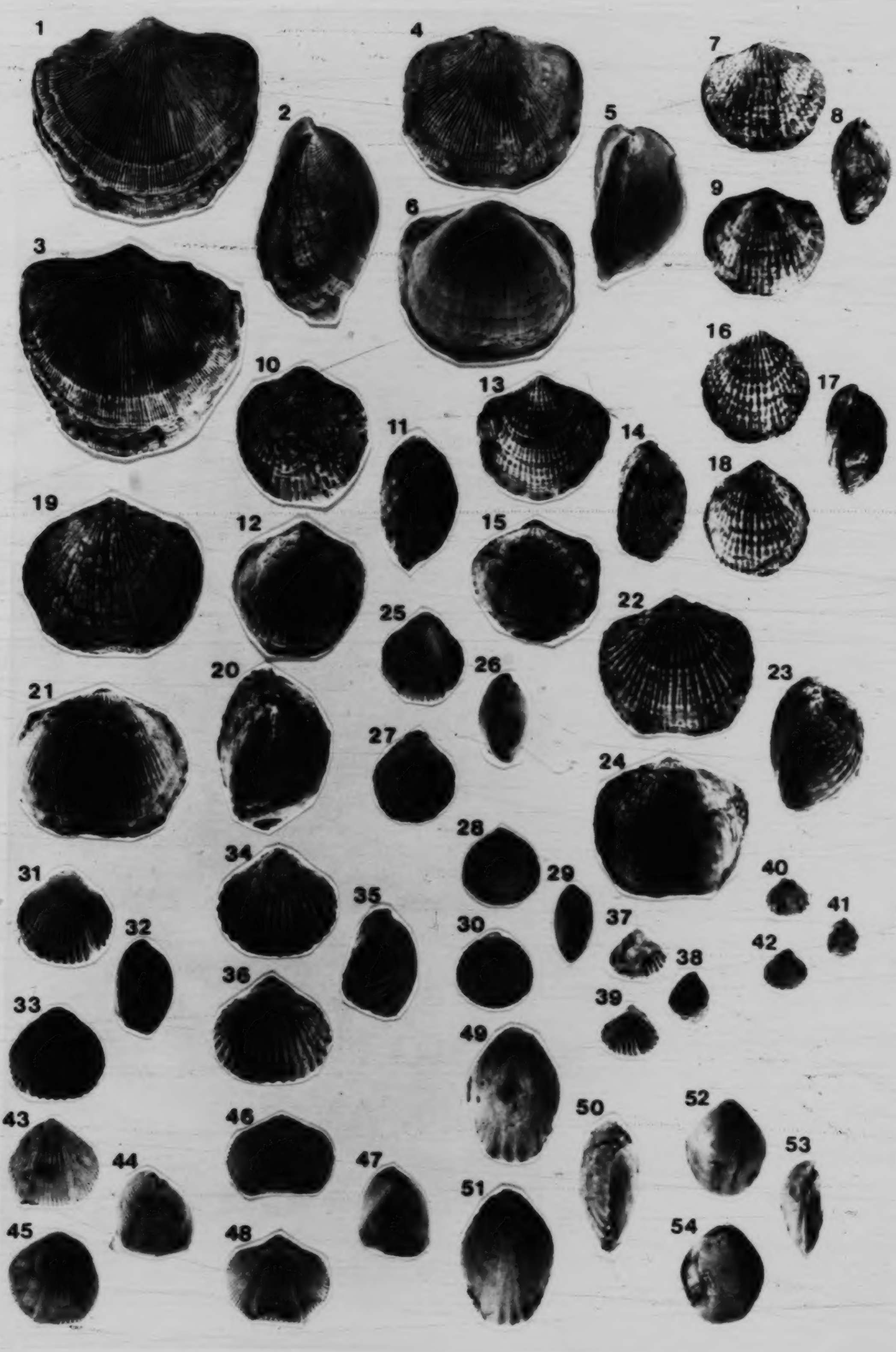
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PLATE 38

Brachiopods from the Bird Fiord Formation (continued). All illustrations x1.

Figures 1-9: *Perryspirifer scheii* Jones & Boucot. Pedicle, lateral and brachial views. 1-3, 7-9 from Norfolk Inlet Spot Sample 7. 4-6 from Section 1981 A 71.0 m.

Figures 10-15: *"Elythyna" sverdrupi* Brice. Pedicle, lateral and brachial views. West North Kent Spot Sample 1.

Figures 16-21: *Warrenella* sp. Pedicle, lateral and brachial views. 16-18 from 1980 Spot Sample 5. 19-21 from South west Arthur Fiord (SWAF) Spot Sample 2/2.

Figures 22-27: *Nucleospira* sp. Pedicle, lateral and brachial views. 22-24 from Section 1981 C 186.0 m. 25-27 from Section 1981 A 224.0 m.

Figures 28-36: *Emanuella*? sp. Pedicle, lateral and brachial views. 28-30 from Section 1980 I 781.5 m. 31-36 from Section 1980 XII 99.0 m.

Figures 37-42: *Protathyris*? sp. Pedicle, lateral and brachial views. SWAF 4/3.

Figures 43-51: *Ivdelinia grinnellensis*? Brice. Pedicle, lateral and brachial views. 43-45 from Section 1981 B 29.0 m. 46-48 from SWAF 2/1. 49-51 from Section 1980 X 99.0 m.

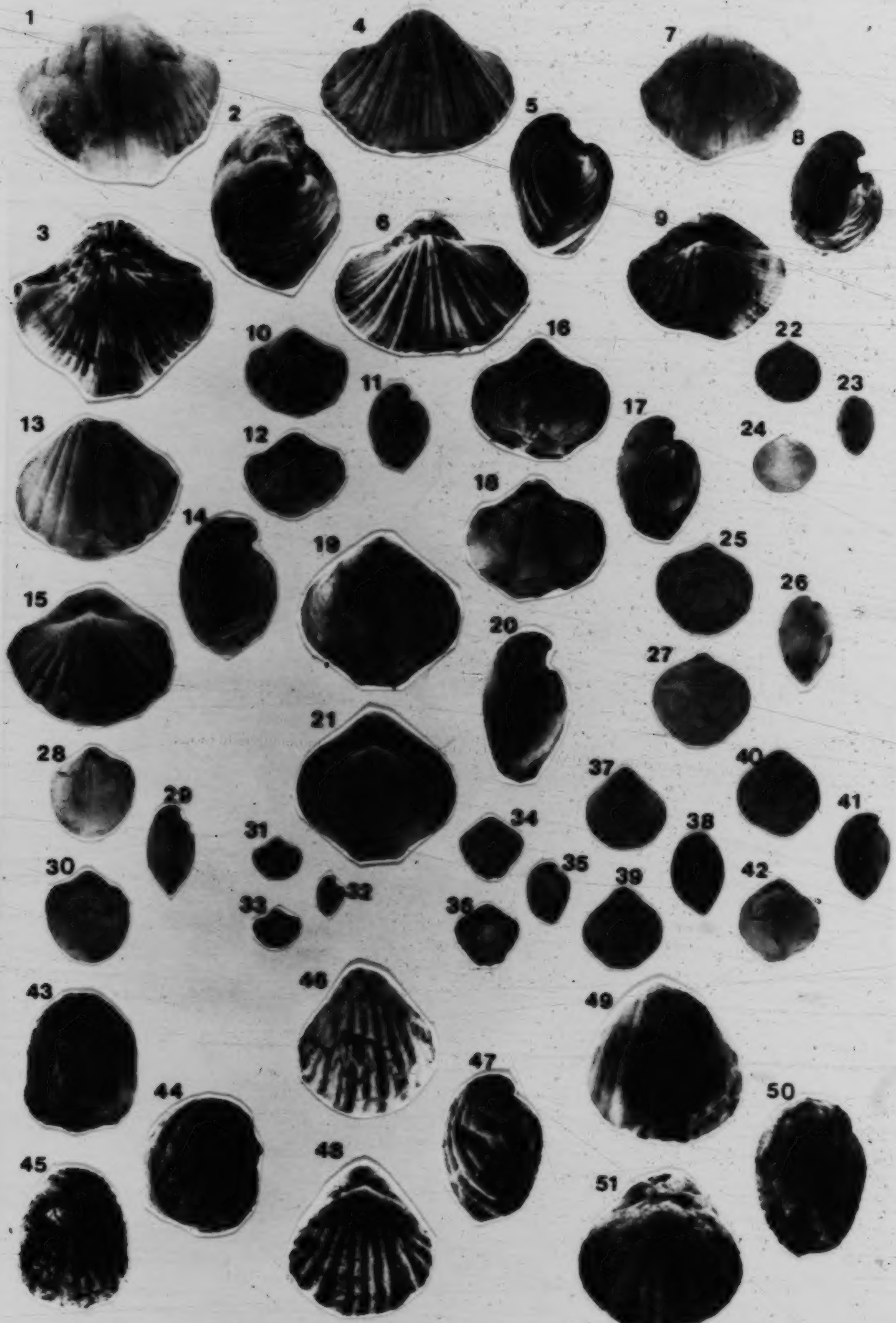
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PLATE 39

Brachiopods from the Bird Fiord Formation (continued). Illustrations x1 unless indicated otherwise.

Figures 1-10: *Schizophoria sulcata* Johnson & Perry. 1-5 Pedicle, lateral and brachial views; 7 interior pedicle valve; 8 exterior pedicle valve. 1-6 from 1980 VIIIA. 7,8 from Section 1981 A 224.0 m.

Figures 9-11: *Bifida* sp. 9,10 x4. 9 internal brachial valve; 10 internal pedicle vavle: 11 x1; External views.

Figures 12-20: *Spinatrypa* sp. 12-17 Pedicle, lateral and brachial views. 18, 19 showing spines on hinge line. 19 internal view pedicle valve (weathered). 12-14 from SWAF 5/4. 15-17 1980 Sec V. 18-20 from 1981 A 138.5 m.

Figures 21-24: "Strophomenid" sp. 81A 224B. 21 internal pedicle valve; 22-24 pedicle, lateral and brachial views. Section 1980 XI 0.0 m.

Figures 25-27: "Strophomenid" sp. 81A 224B? 25+26 external pedicle and brachial views of same specimen; 27 internal pedicle valve. Section 1981 A 224 m.

Figures 28-33: *Phragmostrophia latior*? Pedicle, lateral and brachial views. 28-30 from NI 6; 31-33 from Section 1981 A 138.5 m.

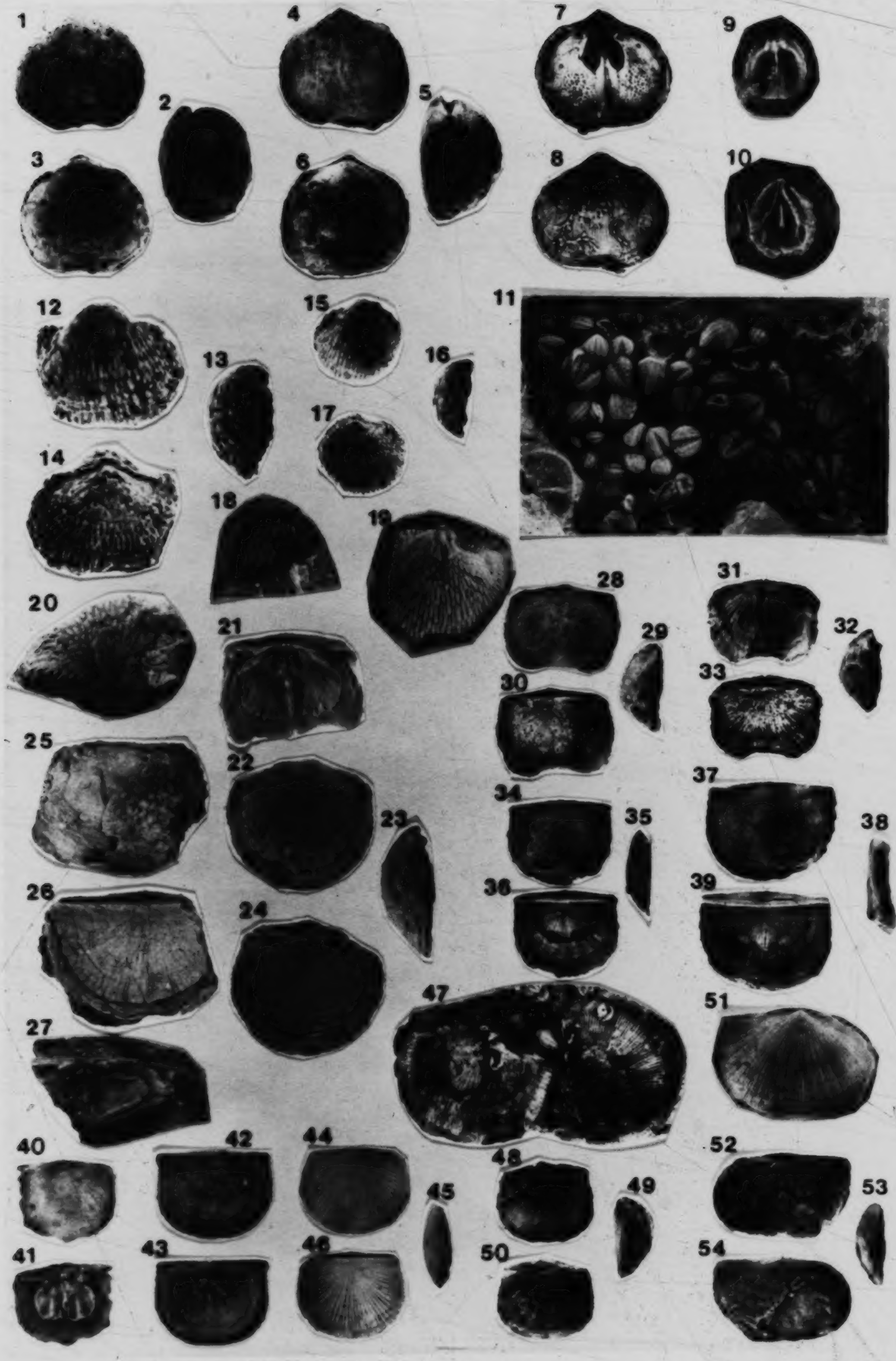
Figures 34-39: *Megastrophia frami* Jones. Pedicle, lateral and brachial views. Section 1981 56.0 m.

Figures 40-46: "Strophomenid" sp. 81A 224. 40,41 External and internal views pedicle valve Section 1981 A 224 m. 42,43 External and internal views brachial valve Section 1981 A 224. 44-46 external pedicle, lateral and brachial views, Section 1980 X1 0.0 m.

Figure 47-50 : *Eoschuchertella*? sp. 47 Internal of brachial and external of pedicle valve. 1980 Section XI 0.0 m. 48-50 pedicle, lateral and brachial views 1980 VIIIA.

Figure 51: "Strophomenid" sec. 1980 V. (? *Eoschuchertella* sp.). External pedicle valve. 1980 Section V.

Figures 52-54: "Strophomenid" sp. 81H 183. 52 weathered pedicle valve; 53, 54 external lateral and brachial views. Section 1981 H 183.0 m.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I. APPENDICES

APPENDIX 1: CONODONTS

Report on conodonts and age identifications from samples collected from the Bird Fiord Formation and adjacent units. Identifications and age assignments by Dr. T.T. Uyeno, Geological Survey of Canada, Calgary. Appendix 1 is a combination of G.S.C. reports # 4-TTU-1984 and # 1-TTU-1985.

BATHURST ISLAND

FIELD IDENTIFIER **LOCALITY, FAUNA, AGE**

80XII 99.0M. Section 1980 XII 99.0 meters above base
South end of Dundee Bight, Bathurst Island
75° 50' 00" N 100° 10' 00" W
Highest Cape De Bray Fm./Lowest Bird Fiord Fm.
Icriodus norfordi Chatterton
Icriodus orri Klapper and Barrick
Age: ***costatus costatus*** Zone

SS10 Mid
Spot sample
Northwest of head of Bracebridge Inlet, Bathurst Island
75° 44' 40" N 98° 54' W
Bird Fiord Formation carbonate equivalent
Icriodus sp. indet.
Age: Latest Silurian - Devonian

SS10 Top
Spot sample
Northwest of head of Bracebridge Inlet, Bathurst Island
75° 44' 40"N 98° 54' W
Bird Fiord Formation carbonate equivalent
Icriodus norfordi Chatterton
Icriodus orri Klapper and Barrick
Ozarkodina? sp.
Pandorinellina expansa Uyeno and Mason
Age: ***costatus costatus*** Zone

80XIII 86.5 m.
Section 1980 XIII 86.5 meters above base
South end of Dundee Bight, Bathurst Island
75° 55' 00" N 99° 57' 00"W
Uppermost Cape De Bray Fm./ Lowest Bird Fiord Fm.
Icriodus norfordi Chatterton
Icriodus orri Klapper and Barrick
Pelekysgnathus sp.
Age: ***costatus costatus*** Zone

80SEC III
Spot sample
4 kilometers east of base of section 80I
South end of Dundee Bight, Bathurst Island
75° 58' 00" N 99° 37' W
Uppermost Cape De Bray Fm./Lowest Bird Fiord Fm.
Polygnathus cooperi cooperi Klapper
Polygnathus coststus costatus Klapper
Polygnathus costatus partitus Klapper, Ziegler, Mashkova
Polygnathus linguiformis bultyncki Weddige
Polygnathus linguiformis subsp. undet.
Icriodus norfordi Chatterton
Age: ***costatus costatus*** Zone

80SSXIII
Spot sample
5 kilometers southeast of Half Moon Bay, Bathurst Island
75° 53' 30" N 99° 47' W

Bird Fiord Formation carbonate equivalent
Icriodus sp.
Polygnathus cf. ***P. linguiformis*** Hinde
Polygnathus sp. indet.
Age: possibly ***costatus costatus*** to lower ***asymmetricus*** Zone
80VIII
Spot sample. 1 kilometer east of section 80X
Approximately equivalent to section 80X 118.0 meters above base
76° 03' 00" N 100° 07' 00" W
Bird Fiord Formation carbonate equivalent
Icriodus norfordi Chatterton
Polygnathus costatus costatus Klapper
Polygnathus cf. ***Polygnathus costatus*** Klapper
Age: ***costatus costatus*** Zone
80X 99.0
Section 80X 99.0 meters above base
Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 07' 00" W
Bird Fiord Formation carbonate equivalent
simple cone (M_2 element)
Age: indeterminate
80X 102.0
Section 80X 102.0 meters above base
Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 07' 00" W
Bird Fiord Formation carbonate equivalent
Icriodus sp.
Age: latest Silurian - Devonian
80X 107.4
Section 80X 107.4 meters above section base
Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 07' 00" W
Bird Fiord Formation carbonate equivalent
Icriodus stephensoni Sparling
Age: ***patulus*** to ***kockelianus*** Zones
8B Basal
Equivalent to Section 80X 118.0 meters above section base
0.5 Km. west of 80X; Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 04' 00" W
Icriodus orri Klapper and Barrick
Polygnathus sp. indet. (2 badly fragmented polygnathan elements)
Age: ***patulus*** to ***kockelianus*** Zones
80X 123.8
Section 80X 123.8 meters above base
Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 07' 00" W
Lowermost Bird Fiord Formation
Icriodus sp. indet.
Polygnathus linguiformis linguiformis Hinde γ morphotype
Polygnathus sp. indet.
Age: ***costatus costatus*** to lower ***asymetricus*** Zones
80XI 54.56
Section 80XI 54.56 meters above base
Stuart Bay Bathurst Island
76° 11' 00" N 100° 00' 00" W
Bird Fiord Formation carbonate equivalent
Icriodus stephensoni Sparling
Icriodus sp.
Age: ***patulus*** to ***kockelianus*** Zone
80XI 61.0
Section 80XI 61.0 meters above base
Stuart Bay, Bathurst Island

76° 11' 00" N 100° 00' 00" W
Bird Fiord Formation carbonate equivalent
Simple cones only (S_2, M_2)
Age:indeterminate

80SSV
Spot sample
XX kilometers southwest of head of Young Inlet, Bathurst Island
76° 22' 30" N 98° 54' W
Bird Fiord Formation carbonate equivalent
Eognathodus bipennatus (Bischoff and Ziegler)
Ozarkodina sp. of Klapper (***in*** Perry ***et al.***, 1974)
Age: ***costatus costatus*** Zone

80SSVII
Spot sample
Ptarmigan River, western Bathurst Island
75° 58' 00" N 97° 47' W
Mapped (***in*** Kerr, 1974 Map 1350A) as Bird Fiord Formation carbonate equivalent
Drepanoistodus suberectus (Branson and Mehl)
Phragmodus flexuosus Moshalenko
Age: Middle Ordovician

DEVON ISLAND: Grinnell Peninsula

81A 61
Section 81A 61.0 meters above base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation carbonate equivalent
Pandorinellina cf. ***P. expansa*** Uyeno & Mason ("Eids-type")
Pandorinellina expansa Uyeno & Mason
Steptotaxis cf. ***S.*** n. sp. A of Uyeno & Klapper (1981)
Age: *serotinus* to ***costatus costatus*** Zones
81A 84
Section 81A 84.0 meters above base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation carbonate equivalent
Pandorinellina expansa Uyeno & Mason
Polygnathus linguiformis bultyncki Weddige
Polygnathus serotinus Telford
Age: *serotinus* to ***costatus costatus*** Zones
81A 138.5
Section 81A 138.5 meters above base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation carbonate equivalent
Eognathodus bipennatus (Bischoff & Ziegler)
Icriodus norfordi Chatterton
Panderodus sp.
Age: *costatus costatus* Zone
81C 120
Section 81C 120.0 meters above base
2 kilometers north of base of section 81A, Ensorcellement River
76° 52' 30" N 94° 53' 00" W
Bird Fiord Formation carbonate equivalent
Pandorinellina expansa Uyeno & Mason
Steptotaxis n. sp. B of Uyeno & Klapper (1981)
Age: *serotinus* to ***costatus costatus*** Zones
81C 186
Section 81C 186.0 meters above section base
2 Kilometers north of section 81A, Ensorcellement River
76° 52' 30" N 94° 53' 00" W
Lowermost Bird Fiord Formation (carbonate interdigitation)
Pandorinellina expansa Uyeno & Mason
Polygnathus linguiformis bultyncki Weddige
Age: *serotinus* to ***costatus costatus*** Zones
81B 0
Section 81B 0.0 meters above base
Banks of Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Bird Fiord Formation carbonate equivalent
Pandorinellina expansa Uyeno & Mason
Pandorinellina cf. ***P. expansa*** Uyeno & Mason ("Eids-type")
Steptotaxis n. sp. A of Uyeno & Klapper (1981)
Age: *serotinus* to ***costatus costatus*** Zones
81B 29
Section 81B 29.0 meters above section base
Banks of Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Bird Fiord Formation carbonate equivalent
Pandorinellina expansa Uyeno & Mason
Age: *inversus* to ***costatus costatus*** Zones
81B 61
Section 81B 61.0 meters above section base

Banks of Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Bird Fiord Formation carbonate equivalent
Icriodus sp. indet.
Age: latest Silurian - Devonian, but probably Middle Devonian based on the general morphology of the icriodids

81D 9.0
Section 81D 9.0 meters above section base
Tucker River, Grinnell Peninsula, Devon Island
76° 41' 00" N 93° 42' 00" W
Top, Bird Fiord Formation carbonate equivalent
Pandorinellina expansa Uyeno & Mason
Age: ***inversus*** to ***costatus costatus*** Zones

SWAF 2/3
Spot sample
10 kilometers west of Arthur Fiord, Grinnell Peninsula
76° 29' N 93° 53' W
Top, Bird Fiord Formation carbonate equivalent
Icriodus sp. indet. (probably same species as in 81B 61)
Icriodus cf. ***I. norfordi*** Chatterton
Icriodus sp.
Age: probably Middle Devonian, ***costatus costatus*** Zone

SWAF 5/7
Spot sample
19 kilometers west of Arthur Fiord, Grinnell Peninsula
76° 39' N 93° 56' W
Lowermost Bird Fiord Formation
Pandorinellina expansa Uyeno & Mason
Age: ***inversus*** to ***costatus costatus*** Zones

DEVON ISLAND: Peninsula north of Norfolk Inlet

NI 1
Spot sample
4 kilometers north of head of Norfolk Inlet
76° 33' N 91° 28' W
Bird Fiord Formation member B/C boundary
Steptotaxis n. sp. A of Uyeno & Klapper (1981)
Age: ***serotinus*** to ***costatus costatus*** Zones

NI 2
Spot sample
4 kilometers north of head of Norfolk Inlet
76° 33' N 91° 28' W
Bird Fiord Formation low member C (approx. 20 meters upsection from NI 1)
Steptotaxis n. sp. A of Uyeno & Klapper (1981)
Steptotaxis n. sp. B of Uyeno & Klapper (1981)
Age: ***serotinus*** to ***costatus costatus*** Zones

NI 5
Spot sample
6 kilometers north of Berkeley Bay
76° 32' N 90° 38' W
Bird Fiord Formation member B/C boundary
Pandorinellina expansa Uyeno & Mason
Steptotaxis sp. (S_1)
Age: ***inversus*** to ***costatus costatus*** Zones

NI 7
Spot sample
10 kilometers northeast of head of Norfolk Inlet
76° 32' N 91° 07' W
Bird Fiord Formation member B/C boundary
Pandorinellina expansa Uyeno & Mason
Steptotaxis? sp. (S_1)

Age: ***inversus*** to ***costatus costatus*** Zones

NI 8
- Spot sample
- 10 kilometers east of head of Norfolk Inlet
- 76° 30' N 91° 10' W
- Near top of Blue Fiord/Disappointment Bay Formation
- ***Polygnathus inversus*** Klapper & Johnson → ***P. serotinus*** Telford
- ***Polygnathus serotinus*** Telford
- ***Steptotaxis*** sp. (small I element)
- ***Pandorinellina expansa*** Uyeno & Mason
- **Age:** ***serotinus*** Zone

NI 9
- Spot sample
- Plateau top by west shore of Berkeley Bay
- 76° 28' 30" N 90° 45' W
- Near top of Blue Fiord/Disappointment Bay Formation
- ***Polygnathus inversus*** Klapper & Johnson
- **Age:*****inversus*** Zone

NORTH KENT ISLAND

WNK 1
- Spot sample
- West coast of North Kent Island 5 kilometers west of lake
- 76° 34' N 90° 12' W
- Bird Fiord Formation, top of member B
- ***Pandorinellina expansa*** Uyeno & Mason
- **Age:** ***inversus*** to ***costatus costatus*** Zones

WNK 2
- Spot sample
- West coast of North Kent Island 5 kilometers west of lake
- 76° 34' N 90° 12' W
- Bird Fiord Formation, lowest member C
- ***Steptotaxis*** n. sp. A of Uyeno & Klapper (1981)
- ***Pandorinellina expansa*** Uyeno & Mason
- **Age:** ***serotinus*** to ***costatus costatus*** Zones

WNK Top 'Blue'
- Spot sample
- West coast of North Kent Island 5 kilometers west of lake
- 76° 34' N 90° 12' W
- Bird Fiord Formation, top member B
- a Pb element that may perhaps be assignable to ***Pandorinellina expansa*** Uyeno & Mason
- **Age:** possibly ***inversus*** to ***costatus costatus*** Zones

81H 178
- Section 81H 178 meters above base
- East coast of North Kent Island 6 kilometers ENE of lake
- 76° 36' 00" N 89° 53' 00" W
- Bird Fiord Formation member B
- ***Panderodus*** sp.
- **Age:** Middle Ordovician - Middle Devonian

ENK 21
- Spot sample
- East coast North Kent Island = Section 81H 231.0 m.
- 76° 36' 00" N 89° 53' 00" W
- Bird Fiord Formation member C
- ***Pandorinellina expansa*** Uyeno & Mason
- ***Pandorinellina*** cf. ***P. expansa*** Uyeno & Mason ("Eids-type")
- ***Steptotaxis*** n. sp. A of Uyeno & Klapper (1981)
- **Age:** ***serotinus*** to ***costatus costatus*** Zones

ENK 14
- Spot sample
- East coast North Kent Island = Section 81H 290.0 m.

76° 36' 00" N 89° 53' 00" W
Icriodus stephensoni Sparling
Age: ***patulus*** to ***kockelianus*** Zones

ELLESMERE ISLAND: South of Schei syncline

81G 279
Section 81G 279.0 meters above base
Blubber Point, Simmons Peninsula
76° 36' 00" N 89° 40' 00" W
Bird Fiord Formation, top member A
A single simple cone (S_1? of icriodontan?)
Age: indeterminate
81G 289
Section 81G 289.0 meters above base
Blubber Point, Simmons Peninsula
76° 36' 00" N 89° 40' 00" W
Bird Fiord Formation, low member B
Pandorinellina expansa Uyeno & Mason (Pb)
Steptotaxis sp. (S_{11} coronellan)
Age:***inversus*** to ***costatus costatus*** Zones
83-PT-51
= Section 82C 0.0 meters above base
East coast north-central Goose Fiord (Bronden locality of Scheii)
76° 41' 00" N 88° 30' 00" W
Bird Fiord Formation, member B
Panderodus sp.
Pandorinellina expansa Uyeno & Mason
Steptotaxis n. sp. B of Uyeno & Klapper (1980)
Steptotaxis sp. indet.
83-PT-53
= Section 82C 1.0 meters above base
East coast north-central Goose Fiord (Bronden locality of Scheii)
76° 41' 00" N 88° 30' 00" W
Bird Fiord Formation, member B
Panderodus sp.
Steptotaxis n. sp. B of Uyeno & Klapper (1980)
Steptotaxis n. sp.
82GFSS2 T-7
Spot sample
East coast north-central Goose Fiord (Bronden locality of Scheii)
= Section 82C 9.0 m.
76° 41' 00" N 88° 30' 00" W
Bird Fiord Formation, upper member B
Panderodus sp.
Age: Middle Ordovician - Middle Devonian
83-PT-54
= Section 82C 13 meters above base
East coast north-central Goose Fiord (Bronden locality of Scheii)
76° 41' 00" N 88° 30' 00" W
Bird Fiord Formation, upper member B
Panderodus sp.
Pandorinellina expansa Uyeno & Mason
Steptotaxis n. sp. A of Uyeno & Klapper (1980)
Steptotaxis n. sp.
82C 13.5
Section 82C 13.5 meters above base
East coast north-central Goose Fiord (Bronden locality of Scheii)
76° 41' 00" N 88° 30' 00" W
Bird Fiord Formation upper member B
Panderodus sp.
Steptotaxis sp. (S_{11} coronellan)

Age: Early to Middle Devonian
82C 16.0
Section 82C 16.0 meters above base
East coast north-central Goose Fiord (Bronden locality of Scheii)
76° 41' 00" N 88° 30' 00" W
Bird Fiord Formation upper member B
Pandorinellina expansa Uyeno & Mason
Steptotaxis cf. ***S. glenisteri*** (Klapper)
Age: ***inversus*** to ***costatus costatus*** Zones
82C 16.8
Section 82C 16.8 meters above base
East coast north-central Goose Fiord (Bronden locality of Scheii)
76° 41' 00" N 88° 30' 00" W
Bird Fiord Formation upper member B
Pandorinellina expansa Uyeno & Mason
Steptotaxis cf. ***S. glenisteri*** (Klapper)
Age: ***inversus*** to ***costatus costatus*** Zones
83-PT-56
= Section 82C1/83 47 meters above base
5 kilometers east of north-central Goose Fiord (by margin of ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation, top member A unit 3
Panderodus sp.
Pandorinellina expansa Uyeno & Mason
Steptotaxis sp. indet.
82C1 206.5
Section 82C1 206.5 meters above base
5 kilometers east of north-central Goose Fiord (by margin of ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation, lowest member B
unassigned simple cone elements only
Age: indeterminate
82C1 207
Section 82C1 207.0 meters above base
5 kilometers east of north-central Goose Fiord (by margin of ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation, lowest member B
Pandorinellina expansa Uyeno & Klapper
Steptotaxis n. sp. B of Uyeno & Klapper (1981)
Age: ***serotinus*** to ***costatus costatus*** Zones
82C1 216
Section 82C1 216.0 meters above base
5 kilometers east of central Goose Fiord (by margin of ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation, member B
Pandorinellina expansa Uyeno & Mason
Steptotaxis n. sp. B of Uyeno & Klapper (1981)
Age: ***serotinus*** to ***costatus costatus*** Zones
82C1 267
Section 82C1 276.0 meters above base
5 kilometers east of central Goose Fiord (by margin of ice cap
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation, low member C
Steptotaxis cf. ***S. glenisteri*** (Klapper)
Age: based on 82C 16.0 + 16.8, probably ***inversus*** to ***costatus costatus*** Zones
82B2 20.5
Section 82B2 20.5 meters above base
10 kilometers north of head of Muskox Fiord
76° 41' 50" N 87° 41' 00" W
Bird Fiord Formation, upper unit 3 member A
Pandorinellina cf. ***P. expansa*** Uyeno & Mason
Age: possibly ***inversus*** to ***costatus costatus*** Zones

82B2 29.5
Section 82B2 29.5 meters above base
10 kilometers north of head of Muskox Fiord
76° 41' 50" N 87° 41' 00" W
Bird Fiord Formation, lowest member B
Pandorinellina cf. ***P. expansa*** Uyeno & Mason
Steptotaxis n. sp. B of Uyeno & Klapper (1981)
Age: None cited.

82B2 32.5
Section 82B2 32.5 meters above base
10 kilometers north of head of Muskox Fiord
76° 41' 50" N 87° 41' 00" W
Bird Fiord Formation, low member B
Steptotaxis n. sp. B of Uyeno & Klapper (1981)
Steptotaxis cf. ***S. glenisteri*** (Klapper)
Age: ***serotinus*** to ***costatus costatus*** Zones

82B2 61.0
Section 82B2 61.0 meters above base
10 kilometers north of head of Muskox Fiord
76° 41' 50" N 87° 41' 00" W
Bird Fiord Formation, member B
Pandorinellina expansa Uyeno & Mason
Steptotaxis cf. ***S. glenisteri*** (Klapper)
Age: ***serotinus*** to ***costatus costatus*** Zones

82B2 114
Section 82B2 114.0 meters above base
10 kilometers north of head of Muskox Fiord
76° 41' 50" N 87° 41' 00" W
Bird Fiord Formation, member C
Pandorinellina expansa Uyeno & Mason
Steptotaxis n. sp. A of Uyeno & Klapper (1981)
Age: ***serotinus*** to ***costatus costatus*** Zones

83-PT-25
= Section 82B4 136 meters above base
9 kilometers northwest of head of Muskox Fiord
76° 42' 10" N 87° 32' 00" W
Bird Fiord Formation, low member C
Panderodus sp.
Pandorinellina expansa Uyeno & Mason

83-PT 30
= Section 82B4 148 meters above base
9 kilometers northwest of head of Muskox Fiord
76° 42' 10" N 87° 32' 00" W
Bird Fiord Formation, member C
Steptotaxis n. sp. A of Uyeno & Klapper (1980)
Steptotaxis n. sp. B of Uyeno & Klapper (1980)
Steptotaxis sp. indet. (small I elements)

83-PT-31
= Section 82B4 150 meters above base
9 kilometers northwest of head of Muskox Fiord
76° 42' 10" N 87° 32' 00" W
Bird Fiord Formation, member C
Steptotaxis n. sp. A of Uyeno & Klapper (1980)
Steptotaxis n. sp. B of Uyeno & Klapper (1980)
Steptotaxis sp. indet. (small I elements)

83A 0.6
Section 83A 0.6 meters above base
22 kilometers north of head of Baad Fiord
76° 50' 00" N 86° 47' 00" W
Bird Fiord Formation, top member B
Steptotaxis sp. (S_{11} coronellan)
Age: Early to Middle Devonian

83A 2.6
Section 83A 2.6 meters above base
22 kilometers north of head of Baad Fiord
76° 50' 00" N 86° 47' 00" W
Bird Fiord Formation, top member B
Pandorinellina expansa Uyeno & Mason
Age:*inversus* to ***costatus costatus*** Zones

ELLESMERE ISLAND: North of Schei syncline

81E 13.5
Section 81E 13.5 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Blue Fiord/Bird Fiord Formation contact
Panderodus sp.
Age: Middle Ordovician to Middle Devonian

81E 26.0
Section 81E 26.0 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Pandorinellina expansa Uyeno & Mason
Steptotaxis n. sp. C of Uyeno & Klapper (1981)
Age: *inversus* to ***costatus costatus*** Zones

81E 79
Section 81E 79.0 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Pandorinellina cf. ***P. expansa*** Uyeno & Mason
Steptotaxis n. sp. C of Uyeno & Klapper (1981)
Age: *inversus* to ***costatus costatus*** Zones

81E 112.5
Section 81E 112.5 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Pandorinellina cf. ***P. expansa*** Uyeno & Mason
Age:possibly ***inversus*** to ***costatus costatus*** Zones

81E 189
Section 81E 189.0 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Pandorinellina expansa Uyeno and Mason
Age: *inversus* to ***costatus costatus*** Zones

81E 214.3
Section 81E 214.3 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Steptotaxis sp. (possibly *S.* n. sp. C of Uyeno & Klapper (1981) based on the S_{21} coronellan elements)
Age: possibly ***inversus*** to ***costatus costatus*** Zones

81E 294.6
Section 81E 294.6 meters above base
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 3
Panderodus sp.
Age: Middle Ordovician - Middle Devonian

81E 326.8
Section 81E 326.8 meters above base

North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 3
Pandorinellina expansa Uyeno & Mason
Polygnathus serotinus Telford
Age: ***serotinus*** to ***costatus costatus*** Zones
81E 346
Section 81E 346.0 meters above section base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 3
Panderodus sp.
Age: Middle Ordovician to Middle Devonian
81E 400
Section 81E 400 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 4
Pandorinellina expansa Uyeno & Mason
Age: ***inversus*** to ***costatus costatus*** Zone
81E 447
Section 81E 447.0 meters above base
North shore, near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 4
Pandorinellina expansa Uyeno & Mason
Age: ***inversus*** to ***costatus costatus*** Zones
81F 14.0
Section 81F 14.0 meters above base
North shore, central Bird Fiord
77° 11' 30" N 86° 44' 00" W
Bird Fiord Formation member F unit 4
Pandorinellina expansa Uyeno & Mason
Age: ***inversus*** to ***costatus costatus*** Zones
79SF G3
= Section 79 Sor Fiord 23.0 meters above base
12 kilometers west southwest of head of Sor Fiord
77° 16' 40" N 85° 00' 00" W
Panderodus sp.
Age: Middle Ordovician to Middle Devonian
79SF G5, G8, G9
= Section 79 Sor Fiord 38, 76.5, 77.0 meters above base
12 kilometers west southwest of head of Sor Fiord
77° 16' 40" N 85° 00' 00" W
Pandorinellina expansa Uyeno & Mason
Age: ***inversus*** to ***costatus costatus*** Zones
79SF G19
= Section 79 Sor Fiord 108.0 meters above base
12 kilometers west southwest of head of Sor Fiord
77° 16' 40" N 85° 00' 00" W
unassigned simple cone (M_2 only)
Age: indeterminate
79SF G28
Section 79 Sor Fiord = 139.0 meters above base
12 kilometers west southwest of head of Sor Fiord
77° 16' 40" N 85° 00' 00" W
Steptotaxis sp. (fragmentary posterior part of I element)
Age: possibly Early to Middle Devonian

GENERAL REMARKS

The "Bird Fiord Formation carbonate equivalent" on Grinnell Peninsula can be broadly correlated with members B and C of the Bird Fiord Formation on Ellesmere and North Kent Islands. The uppermost parts of the Bird Fiord Formation carbonate equivalent on Bathurst Island and on Grinnell Peninsula are probably isochronous, and are dated as ***costatus costatus*** Zone age.

The age of Members B and C on Ellesmere and North Kent Islands and of the Bird Fiord Formation carbonate equivalent on Grinnell Peninsula below the ***costatus costatus*** Zone beds is somewhat problematical. The conodonts from these beds may belong to the ***patulus*** to ***costatus costatus*** Zones interval, and the following reasoning is given for this tentative conclusion:

1/. ***Pandorinellina*** cf. ***P. expansa*** (so-called "Eids-type" in the preceeding lists) was initially reported by Uyeno & Mason (1975, Plate 1, Figure 7) from the Eids Formation, 110 feet above the base of the formation at Twilight Creek (Bathurst Island). There it co-occurs with ***Polygnathus linguiformis bultyncki*** (the range of which is from the ***serotinus*** to ***costatus costatus*** Zones; Klapper & Johnson, 1980). ***P. serotinus*** occurs 90 feet below it, and the underlying "Blue Fiord" Formation contains conodonts of the ***costatus costatus*** Zone.

2/. ***Steptotaxis*** n. spp. A and B, which also occur in these beds, were first reported from the Bird Fiord Formation at its type section (Uyeno & Klapper, 1980). There they occur a short distance above the last occurrence of ***Polygnathus serotinus***, and also above spores that were dated as "early, but not earliest, Eifelian" (McGregor, pers. comm.).

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Uyeno, T.T., and Mason, D. 1975. New Lower and Middle Devonian conodonts from northern Canada. Journal of Paleontology, **49**, pp.710-723.

APPENDIX 2: PALYNOLOGY

Devonian spores in samples of the Cape De Bray Formation, Bird Fiord Formation carbonate equivalent, Bird Fiord and Hecla Bay formations of the Queen Elizabeth Islands (NTS 49B, 49C, 68G, 68H and 69B) submitted to Dr. D.C. McGregor, Geological Survey of Canada, Ottawa. G.S.C. Report # F1-1-1985 DCM.

BATHURST ISLAND

IDENTIFIER **LOCALITY, FLORA, AGE**

80XII 132 (GSC # 100835)
Section 80XII 132 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member C unit 1
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Corystisporites multispinosus Richardson var. ***multispinosus***
Grandispora protea (Naumova) Moreau-Benoit
Grandispora velata (Eisenack) Playford
?Hymenozonotriletes tener Chibrikova var. ***Retusotriletes regulatus*** Riegel
Verruciretusispora dubia (Eisenack) Richardson & Rasul
Conclusions: This assemblage of spores is early but not earliest Eifelian. This sample also contains scolecodonts.

80XII 183 (GSC # 100836)
Section 80XII 183 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member C unit 1
Ancyrospora spp.
Grandispora velata (Eisenack) Playford
Hystricosporites microancyreus Riegel
Kraeuselisporites ollii? (Chibrokova) McGregor & Camfield
Verrucosisporites sp.
Conclusions: The specimens are pitted and corroded, with the result that the sculptural details necessary for identification tend to be obliterated. Nevertheless enough taxa are identifiable to allow the assemblage to be assigned an age within about the middle third of the Eifelian, probably in the ***velata-langii*** Zone of Richardson and McGregor (in press). Scolecodonts are present.

80XII 226 (GSC # 100837) Section 80XII 226.0 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member C unit 1
?Acinosporites lindlarensis Riegel
?Anulatisporites jonkeri Riegel
Apiculatasporites microconus (Richardson) McGregor and Camfield
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Dibolisporites echinaceus (Eisenack) Richardson
Grandispora velata (Eisenack) Playford
Conclusions: The most likely age for this assemblage is early but not earliest Eifelian. Scolecodonts are present.

80XII 319 (GSC # 100838)
Section 80XII 319.0 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation high member C unit 1
Conclusions: Owing to poor preservation none of the spores could be identified without question. ***Kraeuselisporites rugosus*** (Owens) McGregor & Camfield and ***Periplecotriletes tortus*** Egorova may be present. On its general appearance the assemblage is assignable to the Eifelian but no more precise age determination is possible on this evidence alone.

80XII 329 (GSC # 100839)
Section 80XII 329.0 meters above base
2 kilometers south of head of Dundee Bight

75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation low member C unit 2
Anapiculatisporites petilus Richardson
Grandispora velata (Eisenack) Playford
Kraeuselisporites rugosus (Owens) McGregor and Camfield
Conclusions: ***K. rugosus*** has not been found in rocks known to be older than mid-Eifelian. Based on its presence here the rocks at this locality probably are late Eifelian. Scolecodonts, and possibly chitinozoan fragments indicate that the sample is marine.

80XII 374 (GSC # 100840)
Section 80XII 374.0 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member C unit 2
Dibolisporites echinaceus (Eisenack) Richardson
Grandispora megaformis (Richardson) McGregor
Grandispora velata (Eisenack) Playford
Conclusions: The age is Eifelian, but younger than the earliest part of that stage.

80XII 414 (GSC # 100841)
Section 80XII 414.0 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00" W
Bird Fiord Formation low member C unit 2
Anapiculatisporites petilus Richardson
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Grandispora protea? (Naumova) Moreau-Benoit
Conclusions: Based on ***A. petilus*** the sample is probably of late Eifelian age. Scolecodonts are present.

80XII 438 (GSC # 199842)
Section 80XII 438.0 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member C unit 2
Dibolisporites echinaceus (Eisenack) Richardson
Grandispora mammillata? Owens
Grandispora velata (Eisenack) Playford
Conclusions: ***G. mammillata*** has not been found below about mid-Eifelian. On evidence from this meagre assemblage alone, the age is probably late Eifelian or early Givetian. Scolecodonts are present.

80XII 441 (GSC # 100843)
Section 80XII 441.0 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member C unit 2
?Camarozonotriletes mosolovicus Naumova ex Kedo
?Corystisporites multispinosus Richardson var. ***multispinosus***
?Cristatisporites orcadensis Richardson
Densosporites devonicus Richardson
Dibolisporites echinaceus (Eisenack) Richardson
Grandispora mammillata Owens
Grandispora velata (Eisenack) Playford
Kraeuselisporites acerosus (Arkhangelskaya) McGregor & Camfield cf. ***K. ollii*** (Chibrikova) McGregor &Camfield
Retusotriletes rugulatus Riegel
Rhabdosporites langii (Eisenack) Richardson
?Samarisporites amoenus Arkhangelskaya
Conclusions: The spore assembalge is diverse and relatively well preserved. Its age is late Eifelian or, less likely, earliest Givetian, i.e., the ***devonicus-naumovii*** Zone of Richardson and McGregor (in press). Scolecodonts are present.

80XII 528 (GSC # 100844)
Section 80XII 528.0 meters above base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member C/D boundary
Apiculiretusispora densiconata Tiwari & Schaarschmidt

Retusitriletes rugulatus Riegel
Conclusions: The age is probably within the younger two-thirds of the Eifelian. No more precise age determination is possible.
80XII 623 (GCS # 100845)
Section 80XII 623.0 meters above section base
2 kilometers south of head of Dundee Bight
75° 50' 00" N 100° 10' 00"W
Bird Fiord Formation member D
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Corystisporites serratus? (Naumova) McGregor & Camfield
Densosporites devonicus Richardson
Grandispora inculta? Allen
Grandispora protea (Naumova) Moreau-Benoit
Grandispora velata (Eisenack) Playford
Hystricosisporites setigerus? (Naumova ex Kedo) Arkhangelskaya
Rhabdosporites langii (Eisenack) Richardson
Verrucosisporites scurrus (Naumova) McGregor & Camfield
Conclusions: The assemblage is assignable to the ***devonicus-naumovii*** Zone of late Eifelian or early Givetian age.
80XI 54.56 (GSC # 100846)
Section 80XI 54.56 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Top Bird Fiord Formation carbonate equivalent
? Anapiculatisporites petilus Richardson
Apiculatasporites perpusillus (Naumova ex Chibrikova) McGregor
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Conclusions: From this limited evidence I can only conclude that the age is probably Eifelian. The presence of scolecodonts indicates a marine environment of deposition.
80XI 81 (GSC # 100847)
Section 80XI 81.0 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Lowest Bird Fiord Formation
Comments and conclusions: The spores are rare and poorly preserved. ***Grandispora velata*** (Eisenack) Playford is the only identifiable species. It begins in the early (but not earliest) Eifelian and ranges into the Frasnian.
80XI 148 (GSC # 100849) Section 80XI 148.0 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Low Bird Fiord Formation
Acinosporites acanthomammillatus Richardson
Apiculatasporites microconus (Richardson) McGregor & Camfield
Auroraspora macromanifesta (Hacquebard) Richardson
Dibolisporites echinaceus (Eisenack) Richardson
Grandispora velata (Eisenack) Playford
Hystricosporites gravis? Owens
Conclusions: The assemblage is Eifelian but younger than the earliest part of that stage. Early Eifelian age is more likely that late Eifelian, but this conclusion is tentative. Scolecodonts are present.
80XI 164 (GSC # 100850)
Section 80XI 164.0 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation, member C unit 1
Bullatisporites bullatus Allen
Grandispora inculta? Allen
Grandispora velata (Eisenack) Playford
Conclusions: Same as for previous sample.
80XI 164.75 (GSC # 100851)
Section 80XI 164.75 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation, member C unit 1

?Anapiculatisporites petilus Richardson
?Densosporites devonicus Richardson
Dibolisporites echinaceus (Eisenack) Richardson
Grandispora longa? Chi & Hills
Grandispora protea? (Naumova) Moreau-Benoit
Grandispora velata? (Eisenack) Playford
Conclusions: The most reasonable age assignment is about mid-Eifelian. This assignment is tentative. Few of the specimens could be positively identified owing to poor preservation.

80XI 174 (GSC # 100852)
Section 80XI 174.0 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation, member C unit 1
Comments and conclusions: Spores are rare, poorly preserved, and of little use except to suggest possible Eifelian age.

80XI 212.5 (GSC # 100854)
Section 80XI 212.5 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Low Bird Fiord Formation
Comments and conclusions: The only identifiable species is ***Grandispora velata*** which has been recorded from early (but not earliest) Eifelian to Frasnian inclusive.

80XI 227.4 (GSC # 100856)
Section 80XI 227.4 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation, member C unit 1
?Acinosporites acanthomammillatus Richardson
?Archaeozonotriletes amplus Arkhangelskaya
Apiculatasporites microconus (Richardson) McGregor & Camfield
Densosporites devonicus Richardson
Grandispora protea? (Naumova Moreau-Benoit
Grandispora velata (Eisenack) Playford
Rhabdosporites langii (Eisenack) Richardson
Conclusions: The age is mid to late Eifelian, within the ***devonicus-naumovii*** Zone. Scolecodonts are present.

80XI 235 (GSC # 100857)
Section 80XI 235.0 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation member C unit 1
Comments and conclusions: ***Grandispora velata*** (Eisenack) Playford indicates an age range in the early (but not earliest) Eifelian to Frasnian. Scolecodonts are present.

80XI 243.5 (GSC # 199859)
Section 80XI 243.5 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation member C unit 1
Comments and conclusions: ***Grandispora velata*** (Eisenack) Playford is the only identifiable species. The age is in the range early (but not earliest) Eifelian to Frasnian on this evidence. Scolecodonts were also recovered.

80XI 279.8 (GSC # 100860)
Section 80XI 279.8 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation member C unit 1
Grandispora mammillata Owens
Periplecotriletes tortus Egorova
Conclusions: The age is mid-Eifelian.

80XI 298.8 (GSC # 100861)
Section 80XI 298.8 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00"W
Bird Fiord Formation-member C unit 2

Apiculiretusispora densiconata Tiwari & Schaarschmidt
Grandispora velata (Eisenack) Playford
Perotriletes selectus (Arkhangelskaya) McGregor & Camfield
Conclusions: The age is mid to late Eifelian.

80XI 350 (GSC # 100862)
Section 80XI 350.0 meters above base
Stuart Bay, Bathurst Island
76° 11' 00" N 100° 00' 00" W
Bird Fiord Formation member C unit 2
Grandispora velata (Eisenack) Playford
Kraeuselisporites acerosus (Arkhangelskaya) McGregor & Camfield
Conclusions: The most probable age for this meagre assemblage is in the range early (but not earliest) Eifelian to late Eifelian. However I cannot eliminate the possibility that it could be early Givetian.

80Ib 1.5 (GSC # 100882)
Section 80Ib. Extension to top of section 80I
Southeast coast of Dundee Bight
75° 57' 00" N 99° 57' 00" W
Basal Hecla Bay Formation
Apiculatasporites microconus (Richardson) McGregor & Camfield
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Dibolisporites echinaceus (Eisenack) Richardson
? Perotrilites tortus Egorova
Rhabdosporites langii (Eisenack) Richardson
Verrucosisporites premnus? Richardson
Conclusions: The two species that would be most useful for determining the age of the assemblage, ***P. tortus*** and ***V. premnus***, could not be identified positively. Consequently I can only say that the age is Eifelian, about mid-Eifelian.

80Ib 6.0 (GSC # 100883)
Section 80Ib 6.0 meters. Extension to top of section 80I
Southeast coast of Dundee Bight
75° 57' 00" N 99° 57' 00" W
Basal Hecla Bay Formation
Ancyrospora kedoae? (Riegel) Turnau
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Bullatisporites bullatus Allen
Densosporites devonicus Richardson
? Hymenozonotriletes tener Chibrikova
? Kraeusalisporites rugosus (Owens) McGregor and Camfield
Kraeusalisporites acerosus? (Arkhangelskaya) McGregor & Camfield
Perotrilites selectus (Arkhangelskaya) McGregor & Camfield
Retusotriletes rugulatus Riegel
Rhabdosporites langii (Eisenack) Richardson
Verrucosisporites scurrus (Naumova) McGregor & Camfield
Conclusions: This sample contains scolecodonts as well as spores. The age is late Eifelian, ***devonicus-naumovii*** Zone.

80Ib 7.5 (GSC # 100884)
Section 80Ib. Extension to top of section 80I
Southeast coast of Dundee Bight
75° 57' 00" N 99° 57' 00" W
Basal Hecla Bay Formation
Densosporites devonicus Richardson
Hymenozonotriletes tener Chibrikova
Verrucosisporites scurrus (Naumova) McGregor & Camfield
Conclusions: The age is late Eifelian or early Givetian.

80Ib 12.0 (GSC # 100885)
Section 80Ib. Extension to top of section 80I
Southeast coast of Dundee Bight
75° 57' 00" N 99° 57' 00" W
Basal Hecla Bay Formation
Anapiculatisporites petilus Richardson
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Densosporites inaequus? (McGregor) McGregor & Camfield

Dibolisporites echinaceus (Eisenack) Richardson
Grandispora megaformis (Richardson) McGregor
Grandispora protea? (Naumova) Moreau-Benoit
Grandispora velata (Eisenack) Playford
Kraeuselisporites acerosus (Arkhangelskaya) McGregor & Camfield
Rhabdosporites langii (Eisenack) Richardson
Verrucosisporites scurrus (Naumova) McGregor & Camfield
Conclusions: The age is late Eifelian or, less likely, early Givetian (***devonicus***-naumovii Zone).

80Ib 24 (GSC # 100886)
Section 80Ib. Extension to top of section 80I
Southeast coast of Dundee Bight
75° 57' 00" N 99° 57' 00" W
Basal Hecla Bay Formation
Ancyrospora spp.
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Dictyotriletes sp.
Retusotriletes rugulatus Riegel
? Rhabdosporites langii (Eisenack) Richardson
Conclusions: The limits of probable age of this assemblage are mid-Eifelian to early Givetian.

80Ib 28.5 (GSC # 100887)
Section 80Ib. Extension to top of section 80I
Southeast coast of Dundee Bight
75° 57' 00" N 99° 57' 00" W
Basal Hecla Bay Formation
Apiculiretusispora densiconata Tiwari & Schaarschmidt
Grandispora velata? (Eisenack) Playford
? Hymenozonotriletes tener Chibrikova
Retusitriletes rugulatus Riegel
Verrucosisporites scurrus (Naumova) McGregor & Camfield
Conclusions: Same as for previous sample.

ELLESMERE ISLAND: BIRD FIORD AREA

81E 92 (GSC # 100900)
Section 81E 92 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Ancyrospora spp.
Ancyrospora eurypterota Riegel
Apiculiretusispora gaspiensis McGregor
Dibolisporites echinaceus (Eisenack) Richardson
Emphanisporites rotatus McGregor
Retusotriletes rotundus (Streel) Streel
Conclusions: This assemblage is in the ***douglastownense-eurypterota*** Zone, of late Emsian or early Eifelian age, about the same age as the Heisdorf of Lauch formations of the German Eifel region. The Lower-Middle Devonian boundary is at the base of the Lauch. The depositional environments were marine as both scolecodonts and leiospherid scolecodonts are present.

81E 163 (GSC # 100901)
Section 81E 163.0 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
? Apiculiretusispora plicata (Allen)
Bullatisporites bullatus Allen
Dibolisporites echinaceus (Eisenack) Richardson
Hystricosisporites sp. cf. ***Perotrilites ergatus*** Allen
Conclusions: Based on the presence of cf. ***P. ergatus*** this assemblage is assumed to be about the same age as the one from the previous sample. In addition to spores the sample contains scolecodonts and the planktonic alga ***Gloeocapsomorpha prisca*** Zalessky. Structurally, ***G. prisca*** has been compared to the living gelosic alga ***Botryococcus braunii*** Kutzing (see Traverse, 1955) or less commonly to ***Gloeocapsa*** spp. (see Burns, 1982). ***B. braunii*** lives in tropic and temperate zones, usually in relatively clear, quiet fresh water, but occasionally in brackish or salt water (Blackburn, 1936). ***G. prisca*** on the other hand, has been found predominantly in marine rocks in the Paleozoic. Its occurrence in the Bird Fiord Formation with scolecodonts and land plant

spores suggests relatively nearshore, perhaps somewhat protected marine conditions at the site of deposition.

81E 212.8 (GSC # 100902)
Section 81E 212.8 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
?Acinosporites hirsutus (Brideaux & Radforth) McGregor & Camfield
Ancyrospora nettersheimensis? Riegel
Auroraspora macromanifesta (Hacquebard) Richardson
Camarozonotriletes moslovicus Naumova ex Kedo
?Corystisporites multispinosus Richardson var. ***multispinosus***
Densosporites devonicus Richardson
Dibolisporites echinaceus (Eisenack) Richardson
Dibolisporites farraginis McGregor & Camfield
?Geminospora micropaxilla (Owens) McGregor & Camfield
Grandispora mammillata Owens
Grandispora protea? (Naumova) Moreau-Benoit
Grandispora velata (Eisenack) Playford
Hystricosporites gravis Owens
Hystricosporites harpagonis? Owens
Kraeuselisporites rugosus (Owens) McGregor & Camfield
Lophotriletes devonicus (Naumova ex Chibrikova) McGregor & Camfield
?Perotrilites bifurcatus Richardson
Retispora archaelepidophyta (Kedo) McGregor & Camfield
Rhabdosporites langii (Eisenack) Richardson
?Trichodosporites minor Chi & Hills
Verrucosisporites dubia (Eisenack) Richardson & Rasul
Verrucosisporites premnus Richardson
Verrucosisporites scurrus (Naumova) McGregor & Camfield var. ***scurrus***
Verrucosisporites scurrus (Naumova) McGregor & Camfield var ***jugomaschevensis*** Chibrikova
Conclusions: This is an undoubted late Eifelian or early Givetian assemblage of the ***devonicus-naumovii*** Zone. Similar (but less varied) spore assemblages occur in the lower part of the Hecla Bay Formation on the west side of inner Goose Fiord, and about 100-200 meters above the base of the Hecla Bay Formation south-southwest of Sor Fiord (McGregor, 1984); in the Hecla Bay Formation in section 80Ib; and in the upper half of the Weatherall Formation and the lower few meters of the Hecla Bay Formation on eastern Melville Island (McGregor & Camfield, 1982). Rare scolecodonts are present as well.

81E 276 (GSC # 100903)
Section 81E 276.0 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Dibolisporites echinaceus (Eisenack) Richardson cf. ***D. pseudoreticulatus*** Tiwari & Schaarschmidt
Gloeocapsomorpha prisca Zalessky
?Hymenozonotriletes hexus Arkhangelskaya
Conclusions: There is little here on which to base an age determination. ***H. hexus***, tentatively identified, suggests late Eifelian or early Givetian age, based on records of that species in the Soviet Union. This dating must be regarded as tentative. Scolecodonts are present.

81E 361 (GSC # 100905)
Section 81E 361.0 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
?Apiculiretusispora plicata (Allen) Streel
Dibolisporites echinaceus? (Eisenack) Richardson
Retusotriletes rotundus (Streel) Streel
Verrucosisporites scurrus? (Naumova) McGregor & Camfield
Conclusions: ***V. scurrus*** suggests mid-Eifelian to early Frasnian age. No more precise dating can be made on the meagre palynological evidence from this sample. ***Apiculiretusispora plicata*** is probably reworked from an Early Devonian source.

81E 403 (GSC # 100906)
Section 81E 403.0 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
Acinosporites macrospinosus Richardson
?Ancyrospora nettersheimensis Riegel

___Apiculiretusispora densiconata___ Tiwari & Schaarschmidt
___Archaeozonotriletes meandricus___ Allen
___Archaeozonotriletes semanticus___ Chibrikova
? ___Archaeozonotriletes variabilis___ Naumova
*___Clivosispora verrucata___ McGregor var. ___verrucata___
?___Cristatisporites albus___ (Arkhangelskaya) McGregor & Camfield
?___Cymbosporites magnificus___ (McGregor) McGregor & Camfield
___Dibolisporites echinaceus___ (Eisenack) Richardson
___Emphanisporites rotatus___ McGregor
*___Emphanisporites schultzii___ McGregor
___Grandispora mammillata___ Owens
cf. ___Perotriletes___(?) (sic) ___semirutus___ Arkhangelskaya cf. ___Rhabdosporites cymatilus___ Allen ___Rhabdosporites langii___ (Eisenack) Richardson
___Verruciretusispora dubia___ (Eisenack) Richardson & Rasul

Conclusions: This is a mixed assemblage. The species marked by an asterisk are Emsian (or less likely, earliest Eifelian). The youngest elements in the assemblage, however, are probably early Givetian (e.g. ___Archaeozonotriletes variabilis___ and ?___Cymbosporites magnificus___. Several others, e.g. ___Acinosporites macrospinosus___ and ___Grandispora mammillata___ , have not been found below the mid-Eifelian. It seems reasonable to conclude that the sample is early Givetian in age, and the Emsian spores are redeposited.

81E 404 (GSC # 100907)

Section 81E 404.0 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
___Ancyrospora nettersheimensis?___ Riegel
? ___Anulatisporites jonkeri___ Riegel
? ___Archaeozonotriletes divellomedium___ Chibrikova
___Camptozonotriletes aliquantus___ Allen
___Dictyotriletes___ spp. (3 species)
___Emphanisporites schultzii___ McGregor
___Emphanisporites rotatus___ McGregor
___Grandispora diamphida___ Allen
___Grandispora macrotuberculata?___ (Arkhangelskaya) McGregor
___Grandispora___ spp. (3 species) cf. ___Perotriletes___(?) (sic) ___semirutus___ Arkhangelskaya
___Rhabdosporites langii___ (Eisenack) Richardson
___Verruciretusispora dubia___ (Eisenack) Richardson & Rasul

Conclusions: This assemblage, if unmixed, is early, but not earliest Eifelian in age. There are not authenticated records of ___Rhabdosporites langii___ from older rocks, and ___Anulatisporites___ has only been found in the Nohn Formation of early (but not earliest) Eifelian in the Eifel Mountains. However, as late Eifelian to Givetian fossils have been recovered from the underlying approx. 200 meters of the section, alternative conclusions should be considered. ___R. langii___ could be any age from early Eifelian to early Frasnian. Most of the other species are in the age range late Emsian to early Eifelian, and could be reworked. In considering the alternatives I have assumed that there are no structural complications in the field, and that the samples or labels were not mixed in the field or during cataloguing.

81E 406 (GSC # 100908)

Section 81E 406.0 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1
___Ancyrospora loganii?___ McGregor
___Apiculiretusispora densiconata___ Tiwari & Schaarschmidt
___Apiculiretusispora gaspiensis___ McGregor
___Emphanisporites rotatus___ McGregor
___Grandispora velata?___ (Eisenack) Playford
___Rhabdosporites langii___ (Eisenack) Richardson
___Retusotriletes rotundus___ (Streel) Streel
___Verruciretusispora dubia___ (Eisenack) Richardson & Rasul

Conclusions: The age of this assemblage is probably in the range early (but not earliest) Eifelian to late Eifelian. ___G. velata___ and ___R. langii___ have not been found in older rocks and ___A. gaspiensis___ is not known from post-Eifelian strata.

81E 441 (GSC # 100909)

Section 81E 441.0 meters above base. North shore near mouth of Bird Fiord
77° 12' 30" N 87° 02' 00" W
Bird Fiord Formation member F unit 1

? Acinosporites lindlarensis Riegel var. ***lindlarensis***
Apiculiretusispora densiconata Tiwari & Schaarschmidt
? Bullatisporites bullatus Allen
Dibolosporites echinaceus (Eisenack) Richardson
Gloeocapsomorpha prisca Zalessky cf. ***Perotriletes***(?) (sic) ***semirutus*** Arkhangelskaya

Conclusions: This assemblage could be any age from late Emsian to Givetian. The presence of ***G. prisca*** deserves some comment. It is not useful for age determination, but because it is rarely found in palynological assembalges. its presence in three samples in this section suggests that the assemblages containing it may be close to the same age. If the specimens of ***G. prisca*** from localities 100901, 100903 and 100909 are approximately synchronous, and if the assemblage from 100901 is late Emsian as suggested (see above), it follows that ***G. prisca*** (and maybe other species) found at localities 100903 and 100909 would be reworked, as they apparently occur stratigraphically above a sample (from loc. 100902) with undoubted late Eifelian or early Givetian fossils.

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APPENDIX 3: CORALS

Corals identified from the Bird Fiord Formation, Canadian Arctic Archipelago. Samples submitted to Dr. A.E.H. Pedder, Geological Survey of Canada, Calgary. This appendix includes relevant portions of G.S.C. Reports QHG-115-AEHP-1983 and QHG-116-AEHP-1983.

BATHURST ISLAND

IDENTIFIER **LOCALITY, TAXA, AGE**

80XII LOOSE (PCC# 92174)
Lower 100-150 meters section 80XII
South end of Dundee Bight, Bathurst Island
75° 52' N 99° 50' W
Digonophyllum sp. nov.
Age: Devonian, early Eifelian; see comments.

NORTH KENT ISLAND

81H 183 (PCC# 92017)
Section 81H 183 meters above base
East Coast North Kent Island
76° 34' 40" N 89° 53' 30" W
Bird Fiord Formation, member B
Lekanophyllum retiforme Pedder
Age: Devonian, late Dalejan or early Eifelian

81H 230 (PCC# 92072)
Section 81H 230.0 meters above base
East Coast North Kent Island
76° 34' 40" N 89° 53' 30" W
Bird Fiord Formation, member C
Thecipora framensis (Loewe)
Oculipora (?) sp. (= ***Favosites*** sp. B of McLaren, 1963)
Syringopora sp. A of McLaren (1963)
Thecostegites sp.
Lekanophyllum retiforme Pedder
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum sp.
Age: Devonian, late Dalejan or early Eifelian

81H 339 (PCC# 92073)
Section 81H 339.0 meters above base
East Coast North Kent Island
76° 34' 40" N 89° 53' 30" W
Bird Fiord Formation, member C
Cladopora sp.
Age: Silurian or Devonian, but not Famennian

ENK 20 (PCC# 92210)
Spot Sample = 81H 232.0 meters above base
East Coast North Kent Island
76° 34' 40" N 89° 53' 30" W
Lekanophyllum sp. undet. (fragment)
Age: Devonian, Zlichovian to Givetian

ENK 21 (PCC# 92221) Spot Sample = 81H 232.0 meters above base
East Coast North Kent Island
76° 34' 40" N 89° 53' 30" W
Mesophyllum sp.
Taimyrophyllum sp. A of McLaren (1963)
Mansuyphyllum uyenoi avernale Pedder & Goodbody
Age: Devonian, late Dalejan to early Eifelian.

ELLESMERE ISLAND

- 81E 13.5 (UA PCC# 92003)
  - Section 81E 13.5 meters above base
  - North shore near mouth of Bird Fiord 77° 12' 30" N 87° 02' 00" W
  - Blue Fiord/Bird Fiord Formation boundary
  - ***Alveolites altaicus*** Mironova
  - ***Oculipora*** (?) sp. (= ***Favosites*** sp. B of McLaren, 1963)
  - ***Syringopora meyeri*** Loewe
  - ***Spongonaria filicata*** Crickmay
  - **Age:** Early Devonian, Dalejan
- 81E Basal Bird (UA PCC# 92114)
  - Spot sample near base of section 81E
  - North shore near mouth of Bird Fiord 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 1
  - ***Roemeripora*** sp. nov.
  - **Age:** Devonian, Pragian to Frasnian, probably Zlichovian or Dalejan
- 81E 1983 low Bird (UA PCC# 92115) Spot sample approximately 50 meters above base of Bird Fiord Fm.
  - North shore near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 1
  - ***Alveolites altaicus*** Mironova
  - ***Syringopora meyeri*** Loewe
  - ***Aulopora*** sp.
  - ***Spongonaria*** sp. cf. ***S. excavata*** Crickmay
  - **Age:** Early Devonian, Dalejan
- 81E 65.0 (UA PCC# 92008)
  - Section 81E 65.0 meters above base
  - North shore near mouth of Bird Fiord 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 1
  - ***Spongonaria richardsonensis*** Crickmay
  - **Age:** Early Devonian, middle Zlichovian to Dalejan
- 81E 447 (UA PCC# 92045)
  - Section 81E 447.0 meters above base
  - North shore near mouth of Bird Fiord 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 4
  - ***Thamnopora*** sp. nov.
  - **Age:** Devonian, Zlichovian to early Eifelian
- 81G 330 (UA PCC# 92065)
  - Section 81G 330.0 meters above base
  - Blubber Point (=Spakkessen locality of Loewe, 1913)
  - 76° 36' 00" N 89° 35' W
  - Bird Fiord Formation, member B
  - ***Taimyrophyllum*** sp. B of McLaren (1963)
  - **Age:** Devonian, late Dalejan or early Eifelian
- 81G 373.5 (UA PCC# 92067)
  - Section 81G 373.5 meters above base
  - Blubber Point (=Spakkessen locality of Loewe, 1913)
  - 76° 36' 00" N 89° 35' W
  - Bird Fiord Formation, member C
  - ***Alveolites*** sp. A of McLaren (1963)
  - ***Oculipora*** (?) sp. (= ***Favosites*** sp. B of McLaren, 1963)
  - ***Lekanophyllum retiforme*** Pedder
  - ***Taimyrophyllum*** sp. A of McLaren (1963)
  - **Age:** Devonian, late Dalejan or early Eifelian
- 81G 375.5 (UA PCC# 92068)
  - Section 81G 375.5 meters above base
  - Blubber Point (=Spakkessen locality of Loewe, 1913)
  - 76° 36' 00" N 89° 35' W
  - Bird Fiord Formation, member C
  - ***Favosites*** sp.
  - ***Cladopora*** sp.

- ***Alveolites*** sp. A of McLaren (1963)
  - ***Oculipora*** (?) sp. (= ***Favosites*** sp. B of McLaren, 1963)
  - ***Lekanophyllum foliatum*** Pedder & Goodbody
  - ***Lekanophyllum retiforme*** Pedder
  - ***Lekanophyllum rugulosum*** Pedder
  - ***Taimyrophyllum*** sp. A of McLaren (1963)
  - ***Taimyrophyllum*** sp. B of McLaren (1963)
  - ***Mansuyphyllum uyenoi avernale*** Pedder & Goodbody
  - **Age:** Devonian, late Dalejan or early Eifelian
- 81G 378 (UA PCC# 92069)
  - Section 81G 378.0 meters above base
  - Blubber Point (=Spakkessen locality of Loewe, 1913)
  - 76° 36' 00" N 89° 35' W
  - Bird Fiord Formation, member C
  - ***Favosites*** sp.
  - ***Lekanophyllum retiforme*** Pedder
  - **Age:** Devonian, late Dalejan or early Eifelian
- 81G 385 (UA PCC# 92071)
  - Section 81G 378.0 meters above base
  - Blubber Point (=Spakkessen locality of Loewe, 1913)
  - 76° 36' 00" N 89° 35' W
  - Bird Fiord Formation, member C
  - ***Cladopora*** sp.
  - ***Alveolites suborbicularis*** Lamark sensu Loewe (1913)
  - ***Oculipora*** (?) sp. (= ***Favosites sp. B of McLaren, 1963)***
  - ***Syringopora nobilis*** Billings sensu Loewe (1913)
  - ***Lekanophyllum foliatum*** Pedder & Goodbody
  - ***Lekanophyllum retiforme*** Pedder
  - ***Lekanophyllum rugulosum*** Pedder
  - ***Taimyrophyllum*** sp. A of McLaren (1963)
  - ***Mansuyphyllum halleri*** Pedder
  - ***Mansuyphyllum uyenoi avernale*** Pedder & Goodbody
  - **Age:** Devonian, late Dalejan or early Eifelian
- 82B4 112 (UA PCC# 92229)
  - Section 82B4 112.0 meters above base
  - 9 kilometers north northeast of head of Muskox Fiord
  - 76° 42' 26" N 87° 28' W
  - Bird Fiord Formation, top member B
  - ***Favosites*** sp.
  - ***Oculipora*** (?) sp. (= ***Favosites*** sp. B of McLaren, 1963)
  - ***Lekanophyllum foliatum*** Pedder & Goodbody
  - ***Lekanophyllum rugulosum*** Pedder
  - **Age:** Devonian, late Dalejan or early Eifelian
- 82B4 114 (UA PCC# 92230)
  - Section 82B4 114.0 meters above base
  - 9 kilometers north northeast of head of Muskox Fiord
  - 76° 42' 26" N 87° 28' W
  - Bird Fiord Formation, top member B
  - ***Thecipora framensis*** (Loewe)
  - ***Alveolites suborbicularis*** Lamark sensu Loewe (1913)
  - ***Oculipora*** (?) sp. (= ***Favosites*** sp. B of McLaren 1963)
  - ***Lekanophyllum foliatum*** Pedder & Goodbody
  - ***Lekanophyllum retiforme*** Pedder
  - ***Mesophyllum*** sp.
  - ***Mansuyphyllum versicularium*** Pedder & Goodbody
  - **Age:** Devonian, late Dalejan or early Eifelian
- 82B4 130 (UA PCC# 92232)
  - Section 82B4 130.0 meters above base
  - 9 kilometers north northeast of head of Muskox Fiord
  - 76° 42' 26" N 87° 28' W
  - Bird Fiord Formation, member C
  - ***Alveolites suborbicularis*** Lamark sensu Loewe (1913)

Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Taimyrophyllum sp. A of McLaren (1963)
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum comsolum Pedder & Goodbody
Mansuyphyllum halleri Pedder
Age: Devonian, late Dalejan or early Eifelian

82B4 136 (UA PCC# 92233)
Section 82B4 130.0 meters above base
9 kilometers north northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' W
Bird Fiord Formation, member C
Thecipora framensis (Loewe)
Cladopora sp. *Alveolites suborbicularis* Lamark sensu Loewe (1913)
Oculipora (?) sp. (= *Favosites* sp. B of McLaren, 1963)
Syringopora nobilis Billings sensu Loewe (1913)
Syringopora sp. A of McLaren (1963)
Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Lekanophyllum rugulosum Pedder
Taimyrophyllum sp. A of McLaren (1963)
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum halleri Pedder
Age: Devonian, late Dalejan or early Eifelian

82B2 SCREE (UA PCC# 92239)
Section 82B2 scree sample. 70-90 meters above section base
10 kilometers north northwest of head of Muskox Fiord
76° 41' 50" N 87° 41' W
Bird Fiord Formation high member B, low member C
Thecipora framensis (Loewe)
Cladopora sp.
Alveolites suborbicularis Lamark sensu Loewe (1913)
Alveolites sp. A of McLaren (1963)
Oculipora (?) sp.(= *Favosites* sp. B of McLaren, 1963)
Aulopora sp.
Syringopora nobilis Billings sensu Loewe (1913)
Syringopora sp. A of McLaren (1963)
Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Lekanophyllum rugulosum Pedder
Taimyrophyllum sp. B of McLaren (1963)
Age: Devonian, late Dalejan or early Eifelian

82B SS1 (UA PCC# 92240)
Spot Sample, 1.5 kilometers north of section 82B2
11 kilometers north of head of Muskox Fiord
76° 42' 33" N 87° 41' 15" W
Bird Fiord Formation, high member B, low member C
Oculipora (?) sp.(= *Favosites* sp. B of McLaren, 1963)
Aulopora sp.
Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Lekanophyllum rugulosum Pedder
Mesophyllum sp.
Taimyrophyllum sp. A of McLaren (1963)
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum versicularium Pedder & Goodbody
Age: Devonian, late Dalejan or early Eifelian

82B SS2 (UA PCC# 92241)
Spot sample. 1.5 kilometers north of section 82B2
10 kilometers north of head of Muskox Fiord
76° 42' 35" N 87° 41' 00" W
Bird Fiord Formation, high member B, low member C

Cladopora sp.
Aulopora sp.
Lekanophyllum retiforme Pedder
Age: Devonian, late Dalejan or early Eifelian
82B SS3 (UA PCC# 92242)
Spot sample. 1.5 kilometers north of section 82B2
11 kilometers north of head of Muskox Fiord
76° 42' 38" N 87° 41' 40" W
Bird Fiord Formation, high member B, low member C
Syringopora nobilis Billings sensu Loewe (1913)
Moscholasma scheii Pedder & Goodbody
Age: Devonian, late Dalejan or early Eifelian
82B SS4 (UA PCC# 92243)
Spot sample. 1.5 kilometers north of section 82B2
11 kilometers north of head of Muskox Fiord
76° 42' 40" N 87° 40' 00" W
Bird Fiord Formation, high member B, low member C
Lekanophyllum retiforme Pedder
Age: Devonian, late Dalejan or early Eifelian
82B SS5 (UA PCC# 92244)
Spot sample. 1.5 kilometers north of section 82B2
11 kilometers north of head of Muskox Fiord
76° 42' 43" N 87° 39' 30" W
Bird Fiord Formation, member C
Cladopora sp.
Alveolites suborbicularis Lamark sensu Loewe (1913)
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Aulopora sp.
Syringopora sp. A of McLaren (1963)
Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Lekanophyllum rugulosum Pedder
Taimyrophyllum sp. B of McLaren (1963)
Age: Devonian, late Dalejan or early Eifelian
82B SS6 (UA PCC# 92245)
Spot sample. 1.5 kilometers north of section 82B2
11 kilometers north of head of Muskox Fiord
76° 42' 45" N 87° 39' 00" W
Bird Fiord Formation, member C
Alveolites suborbicularis Lamark sensu Loewe (1913)
Alveolites sp. A of McLaren (1963)
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Syringopora nobilis Billings sensu Loewe (1913)
Lekanophyllum retiforme Pedder
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum halleri Pedder
Age: Devonian, late Dalejan or early Eifelian
82B SS7 (UA PCC# 92246)
Spot sample. 1.5 kilometers north of section 82B2
11 kilometers north of head of Muskox Fiord
76° 42' 45" N 87° 39' 00" W
Bird Fiord Formation, member C
Cladopora sp.
Alveolites suborbicularis Lamark sensu Loewe (1913)
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Syringopora nobilis Billings sensu Loewe (1913)
Syringopora sp. A of McLaren (1963)
Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Lekanophyllum rugulosum Pedder
Mesophyllum sp.
Ellesemerelasma pumile Pedder & Goodbody

  - ***Taimyrophyllum*** sp. B of McLaren (1963)
  - ***Mansuyphyllum comsolum*** Pedder & Goodbody
  - ***Mansuyphyllum versicularium*** Pedder & Goodbody
  - **Age:** Devonian, late Dalejan or early Eifelian
- 82C 9 (UA PCC# 92253)
  - Section 82C 9.0 meters above base = Bronden locality of Scheii and Loewe)
  - 7.0 kilometers north of Borgen, Goose Fiord
  - 76° 40' 30" N 88° 27' W
  - Bird Fiord Formation, member B
  - ***Favosites*** sp. cf. ***F. duni*** Etheridge
  - ***Phragmosalpinx australiensis*** Soikolov
  - ***Alveolites altaicus*** Mironova
  - ***Alveolites suborbicularis*** Lamark sensu Loewe (1913) ***Alveolites*** sp. A of McLaren (1963)
  - ***Syringopora nobilis*** Billings sensu loewe (1913)
  - ***Taimyrophyllum*** sp. B of McLaren (1963)
  - ***Mansuyphyllum*** sp. B of McLaren (1963)
  - ***Mansuyphyllum*** sp. (=? ***Cyathophyllum*** sp. A of McLaren, 1963)
  - **Age:** Devonian, late Dalejan or early Eifelian
- 82C 16 (UA PCC# 92257)
  - Section 82C 16.0 meters above base = Bronden locality of Scheii and Loewe)
  - 7.0 kilometers north of Borgen, Goose Fiord
  - 76° 40' 30" N 88° 27' W
  - Bird Fiord Formation, member B
  - ***Alveolites suborbicularis*** Lamark sensu Loewe (1913)
  - ***Schlelasma anserense*** Pedder
  - ***Mansuyphyllum*** (?) sp. indet. (insufficient for sectioning)
  - **Age:** Devonian, Zlichovian to early Eifelian
- 82C 38.0 (UA PCC# 92262)
  - Section 82C 38.0 meters above base = Bronden locality of Scheii and Loewe)
  - 7.0 kilometers north of Borgen, Goose Fiord
  - 76° 40' 30" N 88° 27' W
  - Bird Fiord Formation, base member C
  - ***Chaetetes*** sp. A of McLaren (1963)
  - ***Thecipora framensis*** (Loewe)
  - ***Cladopora*** sp.
  - ***Alveolites*** sp. A of McLaren (1963)
  - ***Alveolites*** sp. B of McLaren (1963)
  - ***Oculipora*** (?) sp. (= ***Favosites*** sp. B of McLaren, 1963)
  - ***Syringopora*** sp. A of McLaren (1963)
  - ***Lekanophyllum retiforme*** Pedder
  - ***Taimyrophyllum*** sp. A of McLaren (1963)
  - ***Taimyrophyllum*** sp. B of McLaren (1963)
  - **Age:** Devonian, late Dalejan or early Eifelian
- 82C 52.5 (UA PCC# 92264)
  - Section 82C 52.5 meters above base = Bronden locality of Scheii and Loewe)
  - 7.0 kilometers north of Borgen, Goose Fiord
  - 76° 40' 30" N 88° 27' W
  - Bird Fiord Formation, member C
  - ***Alveolites suborbicularis*** Lamark sensu Loewe (1913)
  - **Age:** Devonian, Zlichovian to Eifelian
- 82C 105.0 (UA PCC# 92266)
  - Section 82C 105.0 meters above base = Bronden locality of Scheii and Loewe)
  - 7.0 kilometers north of Borgen, Goose Fiord
  - 76° 40' 30" N 88° 27' W
  - Bird Fiord Formation, member C
  - ***Alveolites suborbicularis*** Lamark sensu Loewe (1913)
  - ***Taimyrophyllum*** sp. A of McLaren (1963)
  - **Age:** Devonian, late Dalejan or early Eifelian
- 82GF SS-3 (UA PCC# 92282)
  - Spot sample. 0.5 Km. north of section 82C. = Sandstensodden locality of Schei and Tolmachoff
  - 7.5 kilometers north of Borgen, Goose Fiord
  - 76° 41' 00" N 88° 28' W

Bird Fiord Formation, member C
Chaetetes sp. A of McLaren (1963)
caunopore consortium
Thecipora framensis (Loewe)
Cladopora sp.
Alveolites suborbicularis Lamark sensu Loewe (1913)
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Syringopora meyeri Loewe
Syringopora sp. A of McLaren (1963)
Aulopora sp.
Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Ellesemerelasma pumile Pedder & Goodbody
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum halleri Pedder
Mansuyphyllum sp. (= ***Cyathophyllum*** sp. A of McLaren, 1963)
Age: Devonian, late Dalejan or early Eifelian
82C1 297 (UA PCC# 92295)
Section 82C1 297.0 meters above base
5 kilometers east of north-central Goose Fiord (by ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation, low member D
Chaetetes sp. A of McLaren (1963)
Thecipora framensis (Loewe)
Cladopora sp.
Alveolites suborbicularis Lamark sensu Loewe (1913)
Alveolites sp. B of McLaren (1963),nl> ***Oculipora*** (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Syringopora sp. A of McLaren (1963)
Lekanophyllum retiforme Pedder
Lekanophyllum rugulosum Pedder
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum sp. (= ***Cyathophyllum*** sp. A of McLaren, 1963)
Age: Devonian, late Dalejan or early Eifelian
PT 348 (GSC loc.# C-12497)
Sor Fiord section of Pedder
70.1-70.4 meters above base of Bird Fiord Formation
77° 15' 48" N 85° 03' 30" W
Undifferentiated Bird Fiord Formation
Alveolites sp.
Roemeripora (?) sp. (few corallites only)
Spongonaria loewi (Stumm)
Age: Early Devonian, Zlichovian or Dalejan
PT-83-32 (GSC loc.# C-91486)
=Section 82B3 112.5 meters above base
7 km. north northeast of head of Muskox Fiord
76° 41' 05" N 87° 32' 15" W
Bird Fiord Formation, member A unit 3
Roemeripora sp. nov.
Age: Devonian, Pragian to Frasnian. Probably Zlichovian or Dalejan.
PT-83-52 (GSC loc# 91488)
= Section 82C 12.0 meters above base
Section 82C 105.0 meters above base = Bronden locality of Schei and Loewe
6.5 kilometers north of Borgen Goose Fiord
76° 40' 30" N 88° 27' W
Bird Fiord Formation, member B
Favosites sp. cf. ***F. duni*** Etheridge
Phragmosalpinx austreliensis Sokolov
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Taimyrophyllum sp. A of McLaren (1963)
Age: Devonian, late Dalejan or early Eifelian
PT-83-53 (GSC loc# C-91489)
= Section 82C 12.5 meters above base

Section 82C 105.0 meters above base = Bronden locality of Schei and Loewe
7.0 kilometers north of Borgen Goose Fiord
76° 40' 30" N 88° 27' W
Bird Fiord Formation, member B
Alveolites suborbicularis Lamark sensu Loewe (1913)
Schielasma anserense Pedder
Mansuyphyllum halleri Pedder
Age: Devonian, late Dalejan or early Eifelian

PT-83-57 (GSC loc# C-91493)
Spot sample = Section 82C1 approx. 270.0 m. above base
5 kilometers east of north-central Goose Fiord (by ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation, member C
Taimyrophyllum sp. A of Mclaren (1963)
Age: Devonian, late Dalejan or early Eifelian

PT-83-27 (GSC loc# C-91494)
Spot sample = Section 82B4 approx. 130.0 m. above base
9 kilometers northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' 00" W
Bird Fiord Formation, member C
Thecipora framensis (Loewe)
Cladopora sp.
Alveolites suborbicularis Lamark sensu Loewe (1913)
Syringopora meyeri Loewe
Lekanophyllum retiforme Pedder
Lekanophyllum rugulosum Pedder
Taimyrophyllum sp. B of McLaren (1963)
Age: Devonian, late Dalejan or early Eifelian

PT-83-28 (GSC loc# C-91495)
Spot sample = Section 82B4 approx. 132.0m
9 kilometers northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' 00" W
Bird Fiord Formation, member C
Cladopora sp.
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Lekanophyllum foliatum Pedder & Goodbody
Taimyrophyllum sp. B of McLaren (1963)
Mansuyphyllum comsolum Pedder & Goodbody
Age: Devonian, late Dalejan or early Eifelian

PT-83-26 (GSC loc# C-91496)
Spot sample = Section 82B4 approx. 134.0m
9 kilometers northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' 00" W
Bird Fiord Formation, member C
Cladopora sp.
Alveolites suborbicularis Lamark sensu Loewe (1913)
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Syringopora meyeri Loewe
Syringopora nobilis Billings sensu Loewe (1913)
Syringopora sp. A of McLaren (1963)
Lekanophyllum foliatum Pedder & Goodbody
Taimyrophyllum sp. B of McLaren (1963)
Age: Devonian, late Dalejan or early Eifelian

PT-83-29 (GSC loc# C-91497)
Spot sample = Section 82B4 approx. 134.0m
9 kilometers northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' 00" W
Bird Fiord Formation, member C
Cladopora sp.
Alveolites sp. indet. (fragment)
Oculipora (?) sp.(= ***Favosites*** sp. B of McLaren, 1963)
Mastopora sp.

Syringopora nobilis Billings sensu Loewe (1913)
Lekanophyllum foliatum Pedder & Goodbody
Lekanophyllum retiforme Pedder
Taimyrophyllum sp. B of McLaren (1963)
Schielasma sp. cf. ***S. anserense*** Pedder
Age:Devonian, late Dalejan or early Eifelian.

COMMENTS

Goodbody estimates that the base of the Bird Fiord Formation in Johnson and Perry's (1976) measurement of the Dundee Bight section is near the base of their 579-676 m. interval. ***Polygnathus parwebbi*** was identified by Klapper from the 579 m. level, (Johnson and Perry, 1976, p.618) which should be close to the level from which PCC# 92174 was derived. On this basis, the new species of ***Digonophyllum*** in PCC 92174 should be Eifelian rather than Dalejan. ***Digonophyllum*** is a widespread genus with a known time range of Zlichovian to Givetian.

Faunas from member C of the Bird Fiord Formation on North Kent Island are the same as those discussed by Pedder and Goodbody (1983) from southwestern Ellesmere Island.

The lower beds of the Bird Fiord Formation on the north side of Schei syncline (PCC# 92003, 92008, 92115; GSC loc# C-12497) contain several species of ***Spongonaria*** that occur with Zlichovian or Dalejan conodonts in other parts of the Arctic Archipelago and Yukon Territory. Since the uppermost beds of the underlying Blue Fiord Formation are Dalejan (Uyeno & Klapper, 1980), these lower Bird Fiord Formation occurrences of ***Spongonaria*** must be Dalejan.

The species of ***Roemeripora*** occuring in member A of the Bird Fiord Formation, 7 km. northeast of the head of Muskox Fiord (C-91486); Goodbody section 82B3) is probably the same species as the species occuring at the base of the Bird Fiord Formation on the north shore of Bird Fiord (PCC# 92114). This suggests that Member A of the Bird Fiord Formation, on the south side of Schei syncline is, at least in part, Dalejan.

As discussed previously (Pedder & Goodbody, 1983) members B and C of the Bird Fiord Formation appear to be Dalejan, although the possibility of an early Eifelian age cannot be discounted at present.

The taxonomy applied to the tabulate corals identified in this report is provisional, pending completion of a revision of the Schei collections.

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APPENDIX 4: BRACHIOPODS

Brachiopods collected by Q.H. Goodbody from the Bird Fiord Formation and adjacent units. Preliminary identifications by Dr. B. Jones and Q.H. Goodbody.

BATHURST ISLAND

FIELD IDENTIFIER LOCALITY, FAUNA, NO. OF SPECIMENS

- 80SS13 (UA PCC# 92160)
    - Spot sample 1980 13
    - 5 kilometers southeast of Half Moon Bay, Bathurst Island
    - 75° 53' 30" N 99° 47' W
    - Bird Fiord Formation carbonate equivalent
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 3
    - ***Warrenella*** sp. 2
    - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 2
    - ***Spinulicosta*** sp. 1
- 80SS5 (UA PCC# 92130)
    - Spot sample 1980 5
    - 5.5 kilometers SSE of the head of Young Inlet, Bathurst Island
    - 76° 58' 22" 30" N 98° 54" W
    - Bird Fiord Formation carbonate equivalent
    - ***Bifida*** sp. 340
    - ***Warrenella*** sp. 112
    - Strophomenid sp. 81A-224 40
    - ***Spinulicosta*** sp. 16
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 7
    - ***Spinatrypa (S.) borealis*** (Warren, 1944) 3
- Cornwallis Island spot sample (UA PCC# 92186)
    - Spot sample from north central Cornwallis Island
    - 75° 16' 30" N 94° 14' W
    - Bird Fiord Formation
    - ***Spinatrypa (S.) borealis*** (Warren, 1944) 182
    - ***Cupularostrum repetitor*** Johnson & Perry (1976) 60
    - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 18
    - ***Costacranaena marlenae*** Johnson & Perry (1976) 15
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 4
    - ***Protathyris?*** sp. 3
- Section 1980 V (UA PCC# 92197)
    - Spot sample locality
    - 5 kilometers west of Dundee Bight, Bathurst Island
    - Bird Fiord Formation
    - ***Spinatrypa (S.) borealis*** (Warren, 1944) 476
    - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 317
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 58
    - ***Cupularostrum repetitor*** Johnson & Perry (1976) 54
    - ***Costacranaena marlenae*** Johnson & Perry (1976) 15
    - ***Spinulicosta*** sp. 14
    - Strophomenid sp. section V 5
    - ***Emanuella?*** sp. 4
    - ***Megastrophia frami*** Jones (1982) 1
- Section 1980 I 324 m. (UA PCC# 92147)
    - Section 1980 I 324.0 meters above section base
    - North shore, southern portion of Dundee Bight, Bathurst Island
    - 75° 57' 00" N 99° 57' 00" W
    - Bird Fiord Formation member C uppermost unit 1
    - ***Spinatrypa (S.) borealis*** (Warren, 1944) 22
    - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 15
    - ***Cupularostrum repetitor*** Johnson & Perry (1976) 11
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 10

Spinulicosta sp. 2
Section 1980I 540 1980 section I 540 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member C unit 2
Emanuella? sp. 200
Cupularostrum repetitor Johnson & Perry (1976) 6
Spinatrypa **(*S.*)** ***borealis*** (Warren, 1944) 2
Schizophoria sulcata Johnson & Perry (1976) 2
Anatrypa **(*V.*)** cf. ***arctica*** (Warren, 1944) 1
Section 1980I 559.5-565.5 m. (UA PCC# 92156)
1980 Section I 559.5-565.5 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member C unit 2
Emanuella? sp. 160
Spinatrypa **(*S.*)** ***borealis*** (Warren, 1944) 1
Section 1980I 616.5-636 m. (UA PCC# 92157)
1980 Section 1 559.5-565.5 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member C unit 2
Schizophoria sulcata 206
Anatrypa **(*V.*)** cf. ***arctica*** (Warren, 1944) 17
Spinatrypa **(*S.*)** ***borealis*** (Warren, 1944) 11
Spinulicosta sp. 3
Cupularostrum repetitor Johnson & Perry (1976) 1
Section 1980I 659.25-664.5 m. (UA PCC# 92153)
1980 Section 1 659.25-664.5 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member C unit 2
Anatrypa **(*V.*)** cf. ***arctica*** (Warren, 1944) 602
Cupularostrum repetitor Johnson & Perry (1976) 479
Schizophoria sulcata Johnson & Perry (1976) 303
Spinatrypa **(*S.*)** ***borealis*** (Warren, 1944) 279
Emanuella? sp. 120
Spinulicosta sp. 31
Costacranaena marlenae Johnson & Perry (1976) 23
Atrypa sp. 5
Section 1980I 673.5 m. (UA PCC# 92149)
1980 Section 1 673.5 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member C unit 2
Cupularostrum repetitor Johnson & Perry (1976) 315
Emanuella? sp. 33
Anatrypa **(*V.*)** cf. ***arctica*** (Warren, 1944) 26
Atrypa sp. 21
Schizophoria sulcata Johnson & Perry (1976) 21
Costacranaena marlenae Johnson & Perry (1976) 2
Spinulicosta sp. 1
Section 1980I 678-681 m. (UA PCC# 92151)
1980 Section 1 673.5 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member C unit 2
Anatrypa **(*V.*)** cf. ***arctica*** (Warren, 1944) 30
Cupularostrum repetitor Johnson & Perry (1976) 27
Schizophoria sulcata Johnson & Perry (1976) 9
Spinatrypa **(*S.*)** ***borealis*** (Warren, 1944) 8
Costacranaena marlenae Johnson & Perry (1976) 2

Emanuella? sp. 2
Atrypa sp. 1
Section 1980I 774.45 m. (UA PCC# 92146)
1980 Section I 774.45 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member D unit 1
Emanuella? sp. 300
Cupularostrum repetitor Johnson & Perry (1976) 1
Section 1980I 774.75 m. (UA PCC# 92158)
1980 Section I 774.75 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member D unit 1
Nucleospira sp. 150
Section 1980I 781.5 m. (UA PCC# 92154)
1980 Section I 781.5 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member D unit 1
Emanuella? sp. 69
Cupularostrum repetitor Johnson & Perry (1976) 49
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 7
Section 1980I 819-825 m. (UA PCC# 92152
1980 Section I 819-825 meters above section base
North shore, southern portion of Dundee Bight, Bathurst Island
75° 57' 00" N 99° 57' 00" W
Bird Fiord Formation member D unit 1
Schizophoria sulcata Johnson & Perry (1976) 83
Cupularostrum repetitor Johnson & Perry (1976) 49
Spinulicosta sp. 14
Costacranaena marlenae Johnson & Perry (1976) 12
Emanuella? sp. 8
Section 1980X 85.2 m. (UA PCC# 92161)
1980 Section X 85.2 meters above section base
Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 07' 00" W
Bird Fiord Formation carbonate equivalent
Warrenella sp. 233
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 32
Schizophoria sulcata Johnson & Perry (1976) 1
Spinatrypa (S.) borealis (Warren, 1944) 1
Nucleospira sp. 1
Section 1980X 88.8 m. (UA PCC# 92162)
1980 Section X 88.8 meters above section base
Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 07' 00" W
Bird Fiord Formation carbonate equivalent
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 438
Spinulicosta sp. 38
Warrenella sp. 4
Section 1980X 102.2 m. (UA PCC# 92164)
1980 Section X 102.2 meters above section base
Half Moon Bay, Dundee Bight Bathurst Island
76° 03' 00" N 100° 07' 00" W
Bird Fiord Formation carbonate equivalent
Ivdelinia grinnellensis? Brice (1982) 31
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 2
Nucleospira sp. 1
Spinulicosta sp. 1
Protathyris? sp. 1
Section 1980X 117.0 m. (UA PCC# 92165)

  - 1980 Section X 117.0 meters above section base
  - Half Moon Bay, Dundee Bight Bathurst Island
  - 76° 03' 00" N 100° 07' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Warrenella*** sp. 42
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 13
- Section 1980X 129.0 m. (UA PCC# 92166)
  - 1980 Section X 129.0 meters above section base
  - Half Moon Bay, Dundee Bight Bathurst Island
  - 76° 03' 00" N 100° 07' 00" W
  - Bird Fiord Formation member C unit 1
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 42
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 1
- Section 1980X 228.0 m. (UA PCC# 92173)
  - 1980 Section X 228.0 meters above section base
  - Half Moon Bay, Dundee Bight Bathurst Island
  - 76° 03' 00" N 100° 07' 00" W
  - Bird Fiord Formation member C unit 1
  - ***Nucleospira*** sp. 40
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 18
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 3
- Section 1980X 418.0 m. (UA PCC# 92167)
  - 1980 Section X 228.0 meters above section base
  - Half Moon Bay, Dundee Bight Bathurst Island
  - 76° 03' 00" N 100° 07' 00" W
  - Bird Fiord Formation member C unit 1
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 118
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 2
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 2
- 1980 VIII (UA PCC# 92169)
  - 1980 spot sample VIII. 1 kilometer east of section 1980 X
  - Approximately equivalent to section 1980 X 118.0 meters above section base
  - 76° 03' 00" N 100° 07' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 128
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 77
  - ***Warrenella*** sp. 30
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 7
  - ***Ivdelinia grinnellensis?*** Brice (1982) 3
  - ***Spinulicosta*** sp. 1
- 1980 VIIIA (UA PCC# 92168)
  - 1980 spot sample VIIIA. 1 kilometer east of section 1980 X
  - Approximately equivalent to section 1980 X 118.0 meters above section base
  - 76° 03' 00" N 100° 07' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 185
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 105
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 32
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 26
  - ***Emanuella?*** sp. 12
  - ***Eoschuchertella?*** sp. 2
  - ***Spinulicosta*** sp. 4
  - ***Protathyris?*** sp. 2
- 1980 VIIIB (UA PCC# 92170)
  - 1980 spot sample VIIIB. 1 kilometer east of section 1980 X
  - Approximately equivalent to section 1980 X 118.0 meters above section base
  - 76° 03' 00" N 100° 07' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 63
  - ***Warrenella*** sp. 8
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 3
  - ***Spinulicosta*** sp. 4

  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 1
- Section 1980XI 0.0 m. (UA PCC# 92199)
  - 1980 section XI 0.0 meters above section base
  - Stuart Bay, Bathurst Island
  - 76° 11' 00" N 100° 00' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 293
  - ***Bifida*** sp. 50
  - ***Warrenella*** sp. 48
  - ***Nucleospira*** sp. 17
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 17
  - ***Eoschuchertella?*** sp. 10
  - Strophomenid sp. 81A-224 9
  - Strophomenid sp. 81A-224B 7
  - ***Spinulicosta*** sp. 5
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 2
- Section 1980XI 27 m. (UA PCC# 92200)
  - 1980 section XI 27.0 meters above section base
  - Stuart Bay, Bathurst Island
  - 76° 11' 00" N 100° 00' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 411
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 83
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 11
  - ***Warrenella*** sp. 10
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 7
  - ***Spinulicosta*** sp. 6
  - ***Megastrophia frami*** Jones (1982) 3
  - ***Nucleospira*** sp. 2
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 1
  - ***Ivdelinia grinnellensis?*** Brice (1982) 1
  - ***Eoschuchertella?*** sp. 1
  - ***Protathyris?*** sp. 1
- Section 1980XI 56 m.(UA PCC# 92201)
  - 1980 section XI 56.0 meters above section base
  - Stuart Bay, Bathurst Island
  - 76° 11' 00" N 100° 00' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 21
  - ***Spinulicosta*** sp. 11
  - ***Warrenella*** sp. 8
  - ***Megastrophia frami*** Jones (1982) 8
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 7
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 5
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 3
- Section 1980XI 210.6 m. (UA PCC# 92202)
  - 1980 section XI 56.0 meters above section base
  - Stuart Bay, Bathurst Island
  - 76° 11' 00" N 100° 00' 00" W
  - Bird Fiord Formation carbonate equivalent
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 38
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 25
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 5
  - ***Warrenella*** sp. 3
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 1
  - ***Spinulicosta*** sp. 1
- Section 1980XII 99.0 m. (UA PCC# 92175)
  - 1980 section XII 99.0 meters above section base
  - South end of Dundee Bight, Bathurst Island
  - 75° 50' 00" N 100° 10' 00" W
  - Highest Cape De Bray Fm./Lowest Bird Fiord Fm.
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 4145

  - ***Schizophoria sulcata*** Johnson & Perry (1976) 30
  - ***Emanuella?*** sp. 15
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 3
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 3
- Section 1980XII 118.0 m. (UA PCC# 92178)
  - 1980 section XII 118.0 meters above section base
  - South end of Dundee Bight, Bathurst Island
  - 75° 50' 00" N 100° 10' 00" W
  - Highest Cape De Bray Fm./Lowest Bird Fiord Fm.
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 80
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 16
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 11
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 1
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 1
  - ***Emanuella?*** sp. 1
  - ***Spinulicosta*** sp. 1
- Section 1980XII 160.0 m. (UA PCC# 92179)
  - 1980 section XII 160.0 meters above section base
  - South end of Dundee Bight, Bathurst Island
  - 75° 50' 00" N 100° 10' 00" W
  - Bird Fiord Formation member C unit 1
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 141
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 84
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 69
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 54
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 8
  - ***Emanuella?*** sp. 8
- Section 1980XII 164.0 m. (UA PCC# 92180)
  - 1980 section XII 164.0 meters above section base
  - South end of Dundee Bight, Bathurst Island
  - 75° 50' 00" N 100° 10' 00" W
  - Bird Fiord Formation member C unit 1
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 347
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 215
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 99
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 50
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 32
  - ***Emanuella?*** sp. 7
  - ***Spinulicosta*** sp. 3
- Section 1980XII 264.3 m. (UA PCC# 92182)
  - 1980 section XII 264.3 meters above section base
  - South end of Dundee Bight, Bathurst Island
  - 75° 50' 00" N 100° 10' 00" W
  - Bird Fiord Formation member C unit 1
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 317
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 151
  - ***Atrypa*** sp. 34
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 31
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 26
  - ***Emanuella?*** sp. 3
  - ***Spinulicosta*** sp. 1
- Section 1980XII 201.2 m. (UA PCC# 92185)
  - 1980 section XII 201.2 meters above section base
  - South end of Dundee Bight, Bathurst Island
  - 75° 50' 00" N 100° 10' 00" W
  - Bird Fiord Formation member C unit 2
  - ***Emanuella?*** sp. 150
- Section 1980XII 204.8 m. (UA PCC# 92181)
  - 1980 section XII 204.8 meters above section base
  - South end of Dundee Bight, Bathurst Island
  - 75° 50' 00" N 100° 10' 00" W
  - Bird Fiord Formation member C unit 2

- ***Cupularostrum repetitor*** Johnson & Perry (1976) 364
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 342
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 107
- ***Schizophoria sulcata*** Johnson & Perry (1976) 68
- ***Costacranaena marlenae*** Johnson & Perry (1976) 1
- ***Emanuella?*** sp. 1
- ***Spinulicosta*** sp. 1

Section 1980XII 264.8 m. (UA PCC# 92183)
- 1980 section XII 264.8 meters above section base
- South end of Dundee Bight, Bathurst Island
- 75° 50' 00" N 100° 10' 00" W
- Bird Fiord Formation member C unit 2
- ***Cupularostrum repetitor*** Johnson & Perry (1976) 336
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 221
- ***Costacranaena marlenae*** Johnson & Perry (1976) 28
- ***Schizophoria sulcata*** Johnson & Perry (1976) 25
- ***Atrypa*** sp. 22
- ***Emanuella?*** sp. 12
- ***Spinulicosta*** sp. 1

1980 SS XYZ (UA PCC# 92184)
- 1980 spot sample XYZ. Approximately equivalent to section 80XII 264.3 meters above section base
- South end of Dundee Bight, Bathurst Island
- 75° 50' 00" N 100° 10' 00" W
- Bird Fiord Formation member C unit 2
- ***Schizophoria sulcata*** Johnson & Perry (1976) 54
- ***Costacranaena marlenae*** Johnson & Perry (1976) 6
- ***Atrypa*** sp. 5
- ***Spinulicosta*** sp. 1

1980 SS OPQ (UA PCC# 92176)
- 1980 spot sample OPQ. Approximately equivalent to section 80XII 264.3 meters above section base
- South end of Dundee Bight, Bathurst Island
- 75° 50' 00" N 100° 10' 00" W
- Bird Fiord Formation member C unit 2
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 255
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 99
- ***Schizophoria sulcata*** Johnson & Perry (1976) 87
- ***Cupularostrum repetitor*** Johnson & Perry (1976) 65
- ***Costacranaena marlenae*** Johnson & Perry (1976) 24
- ***Emanuella?*** sp. 9
- ***Spinulicosta*** sp. 3

1980 SS RST (UA PCC# 92177)
- 1980 spot sample RST. Approximately equivalent to section 80XII 264.8 meters above section base
- South end of Dundee Bight, Bathurst Island
- 75° 50' 00" N 100° 10' 00" W
- Bird Fiord Formation member C unit 2
- ***Cupularostrum repetitor*** Johnson & Perry (1976) 436
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 428
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 135
- ***Schizophoria sulcata*** Johnson & Perry (1976) 85
- ***Emanuella?*** sp. 2
- ***Nucleospira*** sp. 1

Section 1980XIII 0.0 m. (UA PCC# 92189)
- 1980 section XIII 0.0 meters above section base
- South end of Dundee Bight, Bathurst Island
- 75° 55' 00" N 99° 57' 00" W
- Highest Cape De Bray Fm./Lowest Bird Fiord Fm.
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 38
- ***Schizophoria sulcata*** Johnson & Perry (1976) 32
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 23
- ***Cupularostrum repetitor*** Johnson & Perry (1976) 8

Section 1980XIII 86.5 m. (UA PCC# 92190)
- 1980 section XIII 86.5 meters above section base

South end of Dundee Bight, Bathurst Island
75° 55' 00" N 99° 57' 00" W
Highest Cape De Bray Fm./Lowest Bird Fiord Fm.
Spinatrypa (S.) borealis (Warren, 1944) 471
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 457
Schizophoria sulcata Johnson & Perry (1976) 69
Cupularostrum repetitor Johnson & Perry (1976) 66

Section 1980XIII 88.5 m. (UA PCC# 92191)
1980 section XII 88.5 meters above section base
South end of Dundee Bight, Bathurst Island
75° 55' 00" N 99° 57' 00" W
Highest Cape De Bray Fm./Lowest Bird Fiord Fm.
Spinatrypa (S.) borealis (Warren, 1944) 602
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 206
Schizophoria sulcata Johnson & Perry (1976) 158
Cupularostrum repetitor Johnson & Perry (1976) 144
Costacranaena marlenae Johnson & Perry (1976) 21
Spinulicosta sp. 4
Emanuella? sp. 1

1980 LOC II-F1 (UA PCC# 92192)
1980 spot sample II-F1. Approximately equivalent to section 80XII 60.0 meters above section base
South end of Dundee Bight, Bathurst Island
75° 55' 00" N 99° 57' 00" W
Highest Cape De Bray Fm./Lowest Bird Fiord Fm.
Spinatrypa (S.) borealis (Warren, 1944) 502
Schizophoria sulcata Johnson & Perry (1976) 158
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 143
Cupularostrum repetitor Johnson & Perry (1976) 135
Spinulicosta sp. 33
Emanuella? sp. 27
Costacranaena marlenae Johnson & Perry (1976) 18

GRINNELL PENINSULA

Section 1981A, 71 m. (UA PCC# 92076)
1981 section 81A 71.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation carbonate equivalent
Cupularostrum repetitor Johnson & Perry (1976) 950
Warrenella sp. 28
Spinatrypa (S.) borealis (Warren, 1944) 15
Schizophoria sulcata Johnson & Perry (1976) 10
Spinulicosta sp. 8
Nucleospira sp. 8
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 8
"Elythyna" sverdrupi Brice (1982) 1
Ivdelinia grinnellensis? Brice (1982) 1
Cupularostrum? sp. A 1
Perryspirifer scheii Jones & Boucot (1983) 1

Section 1981A 73.5 m. (UA PCC# 92197)
1981 section 81A 73.5 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation carbonate equivalent
Schizophoria sulcata Johnson & Perry (1976) 15
Warrenella sp. 11
Perryspirifer scheii Jones & Boucot (1983) 1
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 1
Spinulicosta sp. 1

Section 1981A 138.5 m. (UA PCC# 92078)

1981 section 81A 138.5 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation member C unit 1
Spinatrypa (S.) borealis (Warren, 1944) 629
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 294
Costacranaena marlenae Johnson & Perry (1976) 221
Spinulicosta sp. 132
Strophomenid sp. 81A-224 8
Emanuella? sp. 3
Ivdelinia grinnellensis? Brice (1982) 2
Phragmostrophia latior? 2

Section 1981A 159.5 m. (UA PCC# 92179)
1981 section 81A 159.5 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation member C unit 1
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 233
Spinatrypa (S.) borealis (Warren, 1944) 125
Spinulicosta sp. 56
Schizophoria sulcata Johnson & Perry (1976) 17
Costacranaena marlenae Johnson & Perry (1976) 11
Strophomenid sp. 81A-224 2
Warrenella sp. 1
Phragmostrophia latior? 1
Cupularostrum repetitor Johnson & Perry (1976) 1

Section 1981A 190.0 m. (UA PCC# 92080)
1981 section 81A 190.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation member C unit 1
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 525
Spinatrypa (S.) borealis (Warren, 1944) 331
Costacranaena marlenae Johnson & Perry (1976) 8
Spinulicosta sp. 4
Strophomenid sp. 81A-224 3
Cupularostrum repetitor Johnson & Perry (1976) 3

Section 1981A 224.0 m. (UA PCC# 92081)
1981 section 81A 224.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation member C unit 1
Spinatrypa (S.) borealis (Warren, 1944) 293
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 115
Schizophoria sulcata Johnson & Perry (1976) 60
Costacranaena marlenae Johnson & Perry (1976) 24
Spinulicosta sp. 19
Strophomenid sp. 81A-224B 21
Cupularostrum repetitor Johnson & Perry (1976) 7
Strophomenid sp. 81A-224 5
Nucleospira sp. 5

Section 1981A 256.0 m. (UA PCC# 92082)
1981 section 81A 256.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 00" N 94° 54' 00" W
Bird Fiord Formation member C unit 2
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 155
Schizophoria sulcata Johnson & Perry (1976) 34
Spinulicosta sp. 19
Ivdelinia grinnellensis? Brice (1982) 1
Spinatrypa (S.) borealis (Warren, 1944) 1

Section 1981A 281.0 m. (UA PCC# 92083)

- 1981 section 81A 281.0 meters above section base
- Ensorcellement River, Grinnell Peninsula, Devon Island
- 76° 49' 00" N 94° 54' 00" W
- Bird Fiord Formation member C unit 2
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 710
- ***Schizophoria sulcata*** Johnson & Perry (1976) 69
- ***Spinulicosta*** sp. 33
- ***Phragmostrophia latior?*** 1
- ***Emanuella?*** sp. 1

- Section 1981A 302.0 m. (UA PCC# 92084)
  - 1981 section 81A 302.0 meters above section base
  - Ensorcellement River, Grinnell Peninsula, Devon Island
  - 76° 49' 00" N 94° 54' 00" W
  - Bird Fiord Formation member C unit 2
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 317
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 51
  - ***Spinulicosta*** sp. 32
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 5
  - ***Lingula*** sp. 1
- 1981 Camp 1 (UA PCC# 92090)
  - 1981 spot sample Camp 1. Approximately equivalent to section 81A 260.0 meters above section base
  - Ensorcellement River, Grinnell Peninsula, Devon Island
  - 76° 49' 00" N 94° 54' 00" W
  - Bird Fiord Formation member C unit 2
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 896
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 148
  - ***Spinulicosta*** sp. 39
  - ***Protathyris?*** sp. 14
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 8
  - ***Phragmostrophia latior?*** 6
  - ***Emanuella?*** sp. 5
  - ***Ivdelinia grinnellensis?*** Brice (1982) 3
- Section 1981AX 103.0 m. (UA PCC# 92095)
  - 1981 section 81AX 103.0 meters above section base
  - Ensorcellement River, Grinnell Peninsula, Devon Island
  - 76° 49' 00" N 94° 54' 00" W
  - Bird Fiord Formation member C unit 1
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 70
  - ***Protathyris?*** sp. 33
  - ***Emanuella?*** sp. 17
  - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 13
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 6
- Section 1981B Top Bird Fiord Equiv. (UA PCC# 92101)
  - 1981 section 81B Equivalent to section 81B 27.0 meters above section base
  - Ensorcellement River, Grinnell Peninsula, Devon Island
  - 76° 49' 30" N 94° 36' 00" W
  - Top of Bird Fiord Formation carbonate equivalent
  - ***Atrypa*** sp. 272
  - ***Cupularostrum*** sp. A 100
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 70
  - ***Perryspirifer scheii*** Jones & Boucot (1983) XX
  - ***Warrenella*** sp. 1
  - ***Phragmostrophia latior?*** 1
  - ***"Elythyna" sverdrupi*** Brice (1982) 1
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 1
- Section 1981B 27 m. (UA PCC# 92102)
  - 1981 section 81B 27.0 meters above section base
  - Ensorcellement River, Grinnell Peninsula, Devon Island
  - 76° 49' 30" N 94° 36' 00" W
  - Top of Bird Fiord Formation carbonate equivalent
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 495
  - ***Atrypa*** sp. 142

Schizophoria sulcata Johnson & Perry (1976) 61
Warrenella sp. 5
Phragmostrophia latior? 11
Strophomenid sp. 81A-224B 7
"Elythyna" sverdrupi Brice (1982) 5
Perryspirifer scheii Jones & Boucot (1983) 1

Section 1981B 29.0 m. (UA PCC# 92103)
1981 section 81B 29.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Top of Bird Fiord Formation carbonate equivalent
Ivdelinia grinnellensis? Brice (1982) 79
Atrypa sp. 51
Schizophoria sulcata Johnson & Perry (1976) 46
Warrenella sp. 33
Perryspirifer scheii Jones & Boucot (1983) 22
Spinatrypa (S.) borealis (Warren, 1944) 10
Spinulicosta sp. 9

Section 81B 170 m. (UA PCC# 92104)
1981 section 81B 170.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Bird Fiord Formation member C unit 1
Spinatrypa (S.) borealis (Warren, 1944) 189
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 94
Spinulicosta sp. 94
Schizophoria sulcata Johnson & Perry (1976) 60
Costacranaena marlenae Johnson & Perry (1976) 26
Strophomenid sp. 81A-224 20
Nucleospira sp. 2
Emanuella? sp. 1

Section 81B 175 m. (UA PCC# 92105)
1981 section 81B 175.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Bird Fiord Formation member C unit 1
Spinatrypa (S.) borealis (Warren, 1944) 199
Spinulicosta sp. 117
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 49
Schizophoria sulcata Johnson & Perry (1976) 33
Costacranaena marlenae Johnson & Perry (1976) 19
Strophomenid sp. 81A-224 10
Protathyris? sp. 2
Nucleospira sp. 1

Section 81B 185 m. (UA PCC# 92106)
1981 section 81B 185.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Bird Fiord Formation member C unit 1
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 211
Spinulicosta sp. 10
Schizophoria sulcata Johnson & Perry (1976) 9
Emanuella? sp. 4
Protathyris? sp. 1
Phragmostrophia latior? 1

Section 81B 189 m. (UA PCC# 92107)
1981 section 81B 189.0 meters above section base
Ensorcellement River, Grinnell Peninsula, Devon Island
76° 49' 30" N 94° 36' 00" W
Top of Bird Fiord Formation member C unit 1
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 202
Schizophoria sulcata Johnson & Perry (1976) 21

- ***Spinulicosta*** sp. 8
  - ***Emanuella?*** sp. 6
  - ***Phragmostrophia latior?*** 3
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 1
  - ***Protathyris?*** sp. 1

Section 81B 190 m. (UA PCC# 92108)
- 1981 section 81B 190.0 meters above section base
- Ensorcellement River, Grinnell Peninsula, Devon Island
- 76° 49' 30" N 94° 36' 00" W
- Top of Bird Fiord Formation member C unit 1
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 112
- ***Schizophoria sulcata*** Johnson & Perry (1976) 8
- ***Spinulicosta*** sp. 4
- ***Emanuella?*** sp. 1
- "***Elythyna***" ***sverdrupi*** Brice (1982) 1

Section 81C TOP "BLUE" (UA PCC# 92088)
- 1981 section 81C scree collection
- 2 kilometers north of section 81A. Ensorcellement River
- 76° 52' 30" N 94° 53' 00" W
- Top of Bird Fiord Formation carbonate equivalent
- ***Warrenella*** sp. 15
- ***Schizophoria sulcata*** Johnson & Perry (1976) 1
- ***Perryspirifer scheii*** Jones & Boucot (1983) 1

Section 81C 186 m. (UA PCC# 92187)
- 2 kilometers north of section 81A. Ensorcellement River
- 76° 52' 30" N 94° 53' 00" W
- Lowermost Bird Fiord Formation (carbonate intererdigitation)
- ***Warrenella*** sp. 563
- ***Nucleospira*** sp. 336
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 20
- ***Schizophoria sulcata*** Johnson & Perry (1976) 9
- ***Phragmostrophia latior?*** 2
- ***Costacranaena marlenae*** Johnson & Perry (1976) 1

Section 81D 0.0 m. (UA PCC# 92118)
- Section 81D 0.0 meters above section base
- Tucker River, Grinnell Peninsula, Devon Island
- 76° 41' 00" N 93° 42' 00" W
- Top of Bird Fiord Formation carbonate equivalent
- ***Phragmostrophia latior?*** 200
- ***Cupularostrum repetitor*** Johnson & Perry (1976) 8
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 3

Section 81D 60.0 m. (UA PCC# 92119)
- Tucker River, Grinnell Peninsula, Devon Island
- 76° 41' 00" N 93° 42' 00" W
- Bird Fiord Formation member C unit 1
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 4
- ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 3
- ***Ivdelinia grinnellensis?*** Brice (1982) 3
- ***Warrenella*** sp. 2
- ***Schizophoria sulcata*** Johnson & Perry (1976) 1

SWAF 2/1 (UA PCC# 92131)
- Spot sample
- 10 kilometers west of Arthur Fiord, Grinnell Peninsula
- 76° 29' 00" N 93° 53' 00" W
- Top of Bird Fiord Formation carbonate equivalent
- ***Atrypa*** sp. 211
- ***Ivdelinia grinnellensis?*** Brice (1982) 139
- ***Schizophoria sulcata*** Johnson & Perry (1976) 64
- ***Warrenella*** sp. 59
- ***Spinatrypa (S.) borealis*** (Warren, 1944) 54
- ***Nucleospira*** sp. 8
- "***Elythyna***" ***sverdrupi*** Brice (1982) 8

  - *Spinulicosta* sp. 6
  - *Phragmostrophia latior?* 2
  - *Perryspirifer scheii* Jones & Boucot (1983) 2
  - Strophomenid sp. 81A-224B 1
- SWAF 2/2 (UA PCC# 92132)
  - Spot sample
  - 10 kilometers west of Arthur Fiord, Grinnell Peninsula
  - 76° 29' 00" N 93° 53' 00" W
  - Top of Bird Fiord Formation carbonate equivalent
  - *Warrenella* sp. 318
  - *Spinulicosta* sp. 8
  - *Nucleospira* sp. 5
  - *Phragmostrophia latior?* 1
- SWAF 2/4 (UA PCC# 92133)
  - Spot sample
  - 10 kilometers west of Arthur Fiord, Grinnell Peninsula
  - 76° 29' 00" N 93° 53' 00" W
  - Top of Bird Fiord Formation carbonate equivalent
  - *Anatrypa (V.)* cf. *arctica* (Warren, 1944) 86
  - *Spinulicosta* sp. 69
  - *Emanuella?* sp. 6
  - *Costacranaena marlenae* Johnson & Perry (1976) 4
- SWAF 2/5 (UA PCC# 92134)
  - Spot sample
  - 10 kilometers west of Arthur Fiord, Grinnell Peninsula
  - 76° 29' 00" N 93° 53' 00" W
  - Top of Bird Fiord Formation carbonate equivalent
  - *Anatrypa (V.)* cf. *arctica* (Warren, 1944) 107
  - *Cupularostrum repetitor* Johnson & Perry (1976) 35
  - *Spinulicosta* sp. 24
  - *Spinatrypa (S.) borealis* (Warren, 1944) 6
  - *Emanuella?* sp. 1
  - *Costacranaena marlenae* Johnson & Perry (1976) 1
- SWAF 2/6 (UA PCC# 92135)
  - Spot sample
  - 10 kilometers west of Arthur Fiord, Grinnell Peninsula
  - 76° 29' 00" N 93° 53' 00" W
  - Top of Bird Fiord Formation carbonate equivalent
  - *Spinatrypa (S.) borealis* (Warren, 1944) 230
  - *Costacranaena marlenae* Johnson & Perry (1976) 35
  - *Anatrypa (V.)* cf. *arctica* (Warren, 1944) 25
  - Strophomenid sp. 81A-224 6
  - *Emanuella?* sp. 2
  - *Nucleospira* sp. 1
- SWAF 4/1 (UA PCC# 92138)
  - Spot sample
  - 20 kilometers west of Discovery Mountain, Arthur Fiord, Grinnell Peninsula
  - 76° 34' 20" N 94° 06' W
  - Bird Fiord Formation member C unit 1
  - *Anatrypa (V.)* cf. *arctica* (Warren, 1944) 324
  - *Schizophoria sulcata* Johnson & Perry (1976) 52
  - *Protathyris?* sp. 17
  - *Warrenella* sp. 16
  - *Spinulicosta* sp. 10
  - *Spinatrypa (S.) borealis* (Warren, 1944) 4
  - *Emanuella?* sp. 2
  - *Nucleospira* sp. 1
- SWAF 4/3 (UA PCC# 92139)
  - Spot sample
  - 20 kilometers west of Discovery Mountain, Arthur Fiord, Grinnell Peninsula
  - 76° 34' 20" N 94° 06' W
  - Bird Fiord Formation member C unit 1

Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 146
Schizophoria sulcata Johnson & Perry (1976) 81
Protathyris? sp. 33
Spinulicosta sp. 5
Spinatrypa (S.) borealis (Warren, 1944) 3

SWAF 5/2 (UA PCC# 92142)
Spot sample
19 kilometers west of Arthur Fiord, Grinnell Peninsula
76° 39' N 93° 56' W
Bird Fiord Formation member C unit 1
Cupularostrum repetitor Johnson & Perry (1976) 527
Spinulicosta sp. 3
Nucleospira sp. 2
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 2
Spinatrypa (S.) borealis (Warren, 1944) 1
Costacranaena marlenae Johnson & Perry (1976) 1

SWAF 5/3 (UA PCC# 92143)
Spot sample
19 kilometers west of Arthur Fiord, Grinnell Peninsula
76° 39' N 93° 56' W
Bird Fiord Formation member C unit 1
Spinulicosta sp. 283
Spinatrypa (S.) borealis (Warren, 1944) 48
Atrypa sp. 3
Cupularostrum repetitor Johnson & Perry (1976) 2
Megastrophia frami Jones (1982) 2
Protathyris? sp. 1
Costacranaena marlenae Johnson & Perry (1976) 1

SWAF 5/4 (UA PCC# 921144)
Spot sample
19 kilometers west of Arthur Fiord, Grinnell Peninsula
76° 39'N 93° 56' W
Bird Fiord Formation member C unit 1
Anatrypa (V.) cf. ***arctica*** (Warren, 1944) 202
Spinulicosta sp. 86
Strophomenid sp. 81A-224 15
Costacranaena marlenae Johnson & Perry (1976) 12
Emanuella? sp. 11
Nucleospira sp. 5

DEVON ISLAND (north of Norfolk Inlet) and NORTH KENT ISLAND

NI Spot sample 1 (UA PCC# 92214)
Norfolk Inlet spot sample 1
4 kilometers north of head of Norfolk Inlet
76° 33' N 91° 28' W
Bird Fiord Formation member B/C boundary
Atrypa sp. 243
Schizophoria sulcata Johnson & Perry (1976) 42
Perryspirifer scheii Jones & Boucot (1983) 32
Warrenella sp. 28
"***Elythyna***" ***sverdrupi*** Brice (1982) 22
Cupularostrum? sp. A 5
Strophomenid sp. 81A-224B 2
Nucleospira sp. 2
Phragmostrophia latior? 1
Cupularostrum repetitor Johnson & Perry (1976) 1

NI Spot sample 2 (UA PCC# 92215)
Norfolk Inlet spot sample 2
4 kilometers north of head of Norfolk Inlet
76° 33' N 91° 28' W

- Bird Fiord Formation low member C approx. 20 meters upsection from NI 1
    - ***Atrypa*** sp. 105
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 33
    - ***Cupularostrum?*** sp. A 28
    - ***Phragmostrophia latior?*** 7
    - ***"Elythyna" sverdrupi*** Brice (1982) 4
    - ***Perryspirifer scheii*** Jones & Boucot (1983) 3
- NI Spot sample 6 (UA PCC# 92216)
    - Norfolk Inlet spot sample 6
    - 6 kilometers north of head of Berkeley Bay
    - 76° 32' N 90° 38' W
    - Bird Fiord Formation member B/C boundary
    - ***Atrypa*** sp. 116
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 60
    - ***"Elythyna" sverdrupi*** Brice (1982) 28
    - ***Phragmostrophia latior?*** 24
    - ***Warrenella*** sp. 4
    - ***Spinulicosta*** sp. 3
    - ***Cupularostrum repetitor*** Johnson & Perry (1976) 2
    - ***Perryspirifer scheii*** Jones & Boucot (1983) 1
- NI Spot sample 7 (UA PCC# 92217)
    - Norfolk Inlet spot sample 1
    - 10 kilometers north of head of Norfolk Inlet
    - 76° 32' N 91° 07' W
    - Bird Fiord Formation member B/C boundary
    - ***Atrypa*** sp. 488
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 94
    - ***Warrenella*** sp. 48
    - ***Perryspirifer scheii*** Jones & Boucot (1983) 47
    - ***"Elythyna" sverdrupi*** Brice (1982) 8
    - Strophomenid sp. 81A-224B 6
    - ***Nucleospira*** sp. 4
    - Strophomenid sp. 81H-183 2
    - ***Spinulicosta*** sp. 1
    - ***Cupularostrum repetitor*** Johnson & Perry (1976) 1
- WNK 1 (UA PCC# 92207)
    - West North Kent spot sample 1
    - West coast of North Kent Island 5 kilometers west of lake
    - 76° 34' N 90° 12' W
    - Bird Fiord Formation top of member B
    - ***"Elythyna" sverdrupi*** Brice (1982) 566
    - ***Costacranaena marlenae*** Johnson & Perry (1976) 1
- WNK 2 (UA PCC# 92208)
    - West North Kent spot sample 2
    - West coast of North Kent Island 5 kilometers west of lake
    - 76° 34' N 90° 12' W
    - Bird Fiord Formation lowest member C
    - ***Atrypa*** sp. 186
    - ***Schizophoria sulcata*** Johnson & Perry (1976) 96
    - Strophomenid sp. 8
    - ***Perryspirifer scheii*** Jones & Boucot (1983) 8
    - ***Warrenella*** sp. 4
    - ***"Elythyna" sverdrupi*** Brice (1982) 4
    - ***Anatrypa (V.)*** cf. ***arctica*** (Warren, 1944) 3
    - ***Cupularostrum repetitor*** Johnson & Perry (1976) 3
    - ***Nucleospira*** sp. 3
    - Strophomenid sp. 81A-224B 1
    - ***Protathyris?*** sp. 1
- WNK 3 (UA PCC# 92209)
    - West North Kent spot sample 3
    - West coast of North Kent Island 5 kilometers west of lake
    - 76° 34' N 90° 12' W

Bird Fiord Formation top of member B
Atrypa sp. 68
Perryspirifer scheii Jones & Boucot (1983) 17
"Elythyna" sverdrupi Brice (1982) 10

Section 1981H 183 m. (UA PCC# 92071)
Section 81H 183.0 meters above section base
East coast of North Kent Island 6 kilometers ENE of lake
76° 36' 00" N 89° 53' 00" W
Bird Fiord Formation member B
"Elythyna" sverdrupi Brice (1982) 104
Atrypa sp. 34
Phragmostrophia latior? 24
Strophomenid sp. 81H-183 21
Spinulicosta sp. 9
Schizophoria sulcata Johnson & Perry (1976) 1

Section 1981H 230 m. (UA PCC# 92071
Section 81H 230.0 meters above section base
East coast of North Kent Island 6 kilometers ENE of lake
76° 36' 00" N 89° 53' 00" W
Bird Fiord Formation member C
Atrypa sp. 270
Schizophoria sulcata Johnson & Perry (1976) 49
Cupularostrum? sp. A 20
"Elythyna" sverdrupi Brice (1982) 14
Perryspirifer scheii Jones & Boucot (1983) 9
Phragmostrophia latior? 6
Nucleospira sp. 3
Spinulicosta sp. 3

ELLESMERE ISLAND

Section 1981G 289 m. (UA PCC# 92064)
Section 81G 289.0 meters above section base
Blubber Point, Simmons Peninsula
76° 36' 00" N 89° 40' 00" W
Bird Fiord Formation member B
"Elythyna" sverdrupi Brice (1982) 87
Atrypa sp. 15
Spinulicosta sp. 10
Strophomenid sp. 81H-183 8
Schizophoria sulcata Johnson & Perry (1976) 2
Cupularostrum? sp. A 1
Costacranaena marlenae Johnson & Perry (1976) 1

Section 1981G 330 m. (UA PCC# 92065)
Section 81G 330.0 meters above section base
Blubber Point, Simmons Peninsula
76° 36' 00" N 89° 40' 00" W
Bird Fiord Formation member B
Atrypa sp. 76
Spinulicosta sp. 12
Schizophoria sulcata Johnson & Perry (1976) 10
"Elythyna" sverdrupi Brice (1982) 9
Perryspirifer scheii Jones & Boucot (1983) 6
Nucleospira sp. 4
Phragmostrophia latior? 3
'Rhynchonellid' sp. 2
Cupularostrum? sp. A 2

Section 1981G 373 m (UA PCC# 92066)
Section 81G 373.0 meters above section base
Blubber Point, Simmons Peninsula
76° 36' 00" N 89° 40' 00" W

- Bird Fiord Formation member B
- ***Atrypa*** sp. 43
- ***Schizophoria sulcata*** Johnson & Perry (1976) 5
- ***Perryspirifer scheii*** Jones & Boucot (1983) 4
- ***"Elythyna" sverdrupi*** Brice (1982) 3
- ***Cupularostrum?*** sp. A 1

Section 1981G 373.5 m. (UA PCC# 92068)

- Section 81G 373.5 meters above section base
- Blubber Point, Simmons Peninsula
- 76° 36' 00" N 89° 40' 00" W
- Bird Fiord Formation member B
- ***Atrypa*** sp. 938
- ***Schizophoria sulcata*** Johnson & Perry (1976) 83
- ***Perryspirifer scheii*** Jones & Boucot (1983) 58
- ***Cupularostrum*** sp. A 30
- ***"Elythyna" sverdrupi*** Brice (1982) 21
- ***Nucleospira*** sp. 1
- ***Phragmostrophia latior?*** 1

Section 1981G 378 m. (UA PCC# 92069)

- Section 81G 378.0 meters above section base
- Blubber Point, Simmons Peninsula
- 76° 36' 00" N 89° 40' 00" W
- Bird Fiord Formation member C
- ***Cupularostrum*** sp. A 226
- ***Atrypa*** sp. 344
- ***Schizophoria sulcata*** Johnson & Perry (1976) 21
- ***Nucleospira*** sp. 16
- ***"Elythyna" sverdrupi*** Brice (1982) 7
- ***Cupularostrum repetitor*** Johnson & Perry (1976) 7
- ***Phragmostrophia latior?*** 2
- ***Perryspirifer scheii*** Jones & Boucot (1983) 1

Section 1981G 385 m. (UA PCC# 92070)

- Section 81G 385.0 meters above section base
- Blubber Point, Simmons Peninsula
- 76° 36' 00" N 89° 40' 00" W
- Bird Fiord Formation member C
- ***Atrypa*** sp. 63
- ***"Elythyna" sverdrupi*** Brice (1982) 22
- ***Schizophoria sulcata*** Johnson & Perry (1976) 13
- ***Spinulicosta*** sp. 5
- ***Perryspirifer scheii*** Jones & Boucot (1983) 4

1982 GF Spot sample 1 (UA PCC# 92281)

- Goose Fiord Spot sample 1
- Located along strike between sectioons 82C and 79GF 1 kilometer east of north-central Goose Fiord
- 76° 39' 50" N 88° 28' 00" W
- Bird Fiord Formation upper member B
- ***"Elythyna" sverdrupi*** Brice (1982) 33
- ***Spinulicosta*** sp. 5
- ***Atrypa*** sp. 9
- ***Phragmostrophia latior?*** 1

1982 GF spot sample 2 T-1 (UA PCC# 92270)

- Spot sample = Section 82C 36.4 meters above section base)
- 76° 41' 00" N 88° 30' 00" W
- Bird Fiord Formation lowest member C
- ***Schizophoria sulcata*** Johnson & Perry (1976) 11

1982 GF SS2 T-5 (UA PCC# 92274)

- Spot sample =Section 82C 17.0 meters above section base
- 76° 41' 00" N 88° 30' 00" W
- Bird Fiord Formation member B
- ***"Elythyna" sverdrupi*** Brice (1982) 10
- ***Atrypa*** sp. 6
- ***Spinulicosta*** sp. 4

Phragmostrophia latior? 1

1982 GF SS2 T-6 (UA PCC# 92275)

Spot sample = Section 82C 16.0 meters above section base

76° 41' 00" N 88° 30' 00" W

Bird Fiord Formation member B

Spinatrypa (S.) borealis (Warren, 1944) 1

Spinulicosta sp. 1

Perryspirifer scheii Jones & Boucot (1983) 1

1982 GF SS2 T-7 (UA PCC# 92276)

Spot sample = Section 82C 15.2 meters above section base

76° 41' 00" N 88° 30' 00" W

Bird Fiord Formation member B

"Elythyna" sverdrupi Brice (1982) 87

Atrypa sp. 22

Spinulicosta sp. 1

1982 GF Spot sample 3-1 (UA PCC# 92282)

Spot sample 0.5 kilometers north of section 82C = Bronden locality of Scheii and Loewe

76° 41' N 88° 28' W

Bird Fiord Formation member C

Atrypa sp. 244

"Elythyna" sverdrupi Brice (1982) 34

Schizophoria sulcata Johnson & Perry (1976) 21

Spinulicosta sp. 8

Phragmostrophia latior? 4

1982 GF Spot sample 3-2 (UA PCC# 92283)

Spot sample 0.5 kilometers north of section 82C = Bronden locality of Scheii and Loewe

76° 41' N 88° 28' W

Bird Fiord Formation low member C

Atrypa sp. 32

Schizophoria sulcata Johnson & Perry (1976) 5

"Elythyna" sverdrupi Brice (1982) 1

Nucleospira sp. 1

Phragmostrophia latior? 1

Section 1982C 11.85 m. (UA PCC# 92254)

Section 82C 11.85 meters above section base = Bronden locality of Scheii and Loewe)

7.0 kilometers north of Borgen, Goose Fiord

76° 40' 30" N 88° 27' W

Bird Fiord Formation member B

"Elythyna" sverdrupi Brice (1982) 26

Phragmostrophia latior? 5

Section 1982C 14.3 m. (UA PCC# 92255)

Section 82C 14.3 meters above section base = Bronden locality of Scheii and Loewe)

7.0 kilometers north of Borgen, Goose Fiord

76° 40' 30" N 88° 27' W

Bird Fiord Formation member B

"Elythyna" sverdrupi Brice (1982) 32

Atrypa sp. 24

Section 1982C 46.2 m. (UA PCC# 92263)

Section 82C 46.2 meters above section base = Bronden locality of Scheii and Loewe)

7.0 kilometers north of Borgen, Goose Fiord

76° 40' 30" N 88° 27' W

Bird Fiord Formation member C

Atrypa sp. 70

Schizophoria sulcata Johnson & Perry (1976) 5

Section 1982C1 230.0 m. (UA PCC# 92292)

Section 82C1 230.0 meters above section base

5.0 kilometers east of north-central Goose Fiord (by ice-cap)

76° 38' 10" N 88° 21' 30" W

Bird Fiord Formation member B

"Elythyna" sverdrupi Brice (1982) 189

Atrypa sp. 26

Spinulicosta sp. 7

Strophomenid sp. 81H-183 6
Phragmostrophia latior? 2
Section 1982C1 277.3 m. (UA PCC# 92294)
Section 82C1 277.3 meters above section base
5.0 kilometers east of north-central Goose Fiord (by ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation member C
Atrypa sp. 198
Schizophoria sulcata Johnson & Perry (1976) 11
"Elythyna" sverdrupi Brice (1982) 4
'Rhynchonellid' sp. 2
Section 1982C1 297.0 m. (UA PCC# 92295)
Section 82C1 297.0 meters above section base
5.0 kilometers east of north-central Goose Fiord (by ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation member D
Atrypa sp. 5
Schizophoria sulcata Johnson & Perry (1976) 3
Perryspirifer scheii Jones & Boucot (1983) 2
Section 1982C1 314.55 m. (UA PCC# 92296)
Section 82C1 314.55 meters above section base
5.0 kilometers east of north-central Goose Fiord (by ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation member D
Atrypa sp. 70
Schizophoria sulcata Johnson & Perry (1976) 16
Cupularostrum? sp. A 3
"Elythyna" sverdrupi Brice (1982) 2
Phragmostrophia latior? 1
Nucleospira sp. 1
Section 1982C1 322.0 m. (UA PCC# 92297)
Section 82C1 322.0 meters above section base
5.0 kilometers east of north-central Goose Fiord (by ice-cap)
76° 38' 10" N 88° 21' 30" W
Bird Fiord Formation member D
Atrypa sp. 42
Perryspirifer scheii Jones & Boucot (1983) 17
Section 1982B2 34.5 m. (UA PCC# 92227)
Section 82B2 34.5 meters above section base
10 kilometers north of head of Muskox Fiord
76° 41' 50" N 87° 41' 00" W
Bird Fiord Formation low member B
"Elythyna" sverdrupi Brice (1982) 29
Section 1982B2 41.5 m. (UA PCC# 92228)
Section 82B2 41.5 meters above section base
10 kilometers north of head of Muskox Fiord
76° 41' 50" N 87° 41' 00" W
Bird Fiord Formation low member B
"Elythyna" sverdrupi Brice (1982) 58
Atrypa sp. 3
1982B Spot sample 1 (UA PCC# 92240)
Spot sample, 1.5 kilometers north of section 82B2
11 kilometers north of head of Muskox Fiord
76° 42' 30" N 87° 41' 15" W
Bird Fiord Formation, high member B, low member C
Spinatrypa (S.) borealis (Warren, 1944) 37
Atrypa sp. 35
"Elythyna" sverdrupi Brice (1982) 9
Perryspirifer scheii Jones & Boucot (1983) 14
Schizophoria sulcata Johnson & Perry (1976) 5
Emanuella? sp. 2
'Rhynchonellid' sp. 6

  - ***Phragmostrophia latior?*** 1
- 1982 B Spot sample 3 (UA PCC# 92242)
  - Spot sample, 1.5 kilometers north of section 82B2
  - 11 kilometers north of head of Muskox Fiord
  - 76° 42' 38" N 87° 41' 00" W
  - Bird Fiord Formation, high member B, low member C
  - ***"Elythyna" sverdrupi*** Brice (1982) 68
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 21
  - ***Atrypa*** sp. 18
  - Strophomenid sp. 81H-183 15
  - ***Phragmostrophia latior?*** 7
  - ***Spinulicosta*** sp. 2
  - ***Nucleospira*** sp. 1
  - 'Rhynchonellid' sp. 1
- 1982 B Spot sample 4 (UA PCC# 92243)
  - Spot sample, 1.5 kilometers north of section 82B2
  - 11 kilometers north of head of Muskox Fiord
  - 76° 42' 40" N 87° 40' 00" W
  - Bird Fiord Formation, high member B, low member C
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 66
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 30
  - ***Atrypa*** sp. 27
  - ***Phragmostrophia latior?*** 1
  - ***"Elythyna" sverdrupi*** Brice (1982) 1
- 1982 B Spot sample 5 (UA PCC# 92244) Spot sample, 1.5 kilometers north of section 82B2
  - 11 kilometers north of head of Muskox Fiord
  - 76° 42' 43" N 87° 39' 30" W
  - Bird Fiord Formation member C
  - ***Atrypa*** sp. 18
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 6
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 1
  - ***"Elythyna" sverdrupi*** Brice (1982) 1
- 1982 B Spot sample 7 (UA PCC# 92246)
  - Spot sample, 1.5 kilometers north of section 82B2
  - 11 kilometers north of head of Muskox Fiord
  - 76° 42' 45" N 87° 39' 00" W
  - Bird Fiord Formation member C
  - ***Atrypa*** sp. 73
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 43
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 5
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 4
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 2
  - ***Phragmostrophia latior?*** 1
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 1
  - ***Emanuella?*** sp. 1
- 1982 B Spot sample 8 (UA PCC# 92247)
  - Spot sample, 1.5 kilometers north of section 82B2
  - 11 kilometers north of head of Muskox Fiord
  - 76° 42' 39" N 87° 41' 00" W
  - Bird Fiord Formation low member C
  - ***Atrypa*** sp. 192
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 32
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 4
  - ***"Elythyna" sverdrupi*** Brice (1982) 3
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 2
- 1982 B Spot sample 9 (UA PCC# 92248) Spot sample, 1.5 kilometers north of section 82B2
  - 11 kilometers north of head of Muskox Fiord
  - 76° 42' 38" N 87° 41' 00" W
  - Bird Fiord Formation member C
  - ***Atrypa*** sp. 280
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 5
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 4

Cupularostrum repetitor Johnson & Perry (1976) 4
Spinulicosta sp. 3
Phragmostrophia latior? 2

Section 1982B2 scree (UA PCC# 92239)
Section 82B2 Scree sample. 70-90 meters above section base
10 kilometers north of head of Muskox Fiord
76° 42' 38" N 87° 41' 00" W
Bird Fiord Formation member B
Atrypa sp. 48
"Elythyna" sverdrupi Brice (1982) 17
Perryspirifer scheii Jones & Boucot (1983) 6
Schizophoria sulcata Johnson & Perry (1976) 2
Cupularostrum? sp. A 1

Section 1982B4 112 m. (UA PCC# 92229)
Section 82B4 112.0 meters above section base
9 kilometers northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' 00" W
Bird Fiord Formation member C
"Elythyna" sverdrupi Brice (1982) 80
Atrypa sp. 38
Perryspirifer scheii Jones & Boucot (1983) 8
Schizophoria sulcata Johnson & Perry (1976) 1
Spinulicosta sp. 1

Section 1982B4 114 m. (UA PCC# 92230)
Section 82B4 114.0 meters above section base
9 kilometers northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' 00" W
Bird Fiord Formation member C
Atrypa sp. 70
"Elythyna" sverdrupi Brice (1982) 40
Perryspirifer scheii Jones & Boucot (1983) 27
Schizophoria sulcata Johnson & Perry (1976) 7
Spinulicosta sp. 1
'Rhynchonellid' sp. 1
Strophomenid indet. 1

Section 1982B4 126 m. (UA PCC# 92231)
Section 82B4 126.0 meters above section base
9 kilometers northeast of head of Muskox Fiord
76° 42' 26" N 87° 28' W
Bird Fiord Formation member C
Atrypa sp. 62
Perryspirifer scheii Jones & Boucot (1983) 21
Schizophoria sulcata Johnson & Perry (1976) 10
"Elythyna" sverdrupi Brice (1982) 2

Section 1982B4 130 m. (UA PCC# 92232)
Section 82B4 130.0 meters above section base
9 kilometers north of head of Muskox Fiord
76° 42' 26" N 87° 28' W
Bird Fiord Formation member C
Atrypa sp. 53
Perryspirifer scheii Jones & Boucot (1983) 16
"Elythyna" sverdrupi Brice (1982) 16
Spinatrypa (S.) borealis (Warren, 1944) 2
Phragmostrophia latior? 1

Section 1982B4 136 m. (UA PCC# 92233)
Section 82B4 136.0 meters above section base
9 kilometers north of head of Muskox Fiord
76° 42' 26" N 87° 28' W
Bird Fiord Formation, high member B, low member C
Atrypa sp. 13
Spinatrypa (S.) borealis (Warren, 1944) 1
Perryspirifer scheii Jones & Boucot (1983) 1

- Section 1982B4 147 m. (UA PCC# 92234)
  - Section 82B4 147.0 meters above section base
  - 9 kilometers north of head of Muskox Fiord
  - 76° 42' 26" N 87° 28' W
  - Bird Fiord Formation high member C
  - ***Atrypa*** sp. 302
- Section 1982B4 149 m (UA PCC# 92235)
  - N Section 82B4 149.0 meters above section base
  - 9 kilometers north of head of Muskox Fiord
  - 76° 42' 26" N 87° 28' W
  - Bird Fiord Formation high member C
  - ***Atrypa*** sp. 103
- Section 1983A 48.4 m. (UA PCC# 92298)
  - Section 83A 48.4 meters above section base
  - 22.0 kilometers north of head of Baad Fiord
  - 76° 50' 00" N 86° 47' 00" W
  - Bird Fiord Formation member C
  - ***"Elythyna" sverdrupi*** Brice (1982) 50
  - ***Atrypa*** sp. 2
- Section 1983A 49.2 m. (UA PCC# 92299)
  - Section 83A 49.2 meters above section base
  - 22.0 kilometers north of head of Baad Fiord
  - 76° 50' 00" N 86° 47' 00" W
  - Bird Fiord Formation member C
  - ***Atrypa*** sp. 14
  - ***"Elythyna" sverdrupi*** Brice (1982) 1
  - ***Spinulicosta*** sp. 1
- Section 1983A 52.4 m. (UA PCC# 92304)
  - Section 83A 52.4 meters above section base
  - 22.0 kilometers north of head of Baad Fiord
  - 76° 50' 00" N 86° 47' 00" W
  - Bird Fiord Formation member C
  - ***"Elythyna" sverdrupi*** Brice (1982) 50
- Section 1983A 64.25 m. (UA PCC# 92300)
  - Section 83A 64.25 meters above section base
  - 22.0 kilometers north of head of Baad Fiord
  - 76° 50' 00" N 86° 47' 00" W
  - Bird Fiord Formation member C
  - ***Atrypa*** sp. 2
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 1
- Section 1983A 64.75 m. (UA PCC# 92301)
  - Section 83A 64.75 meters above section base
  - 22.0 kilometers north of head of Baad Fiord
  - 76° 50' 00" N 86° 47' 00" W
  - Bird Fiord Formation member C
  - ***Atrypa*** sp. 37
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 4
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 1
- Section 1983A 65.0 m. (UA PCC# 92302)
  - Section 83A 65.0 meters above section base
  - 22.0 kilometers north of head of Baad Fiord
  - 76° 50' 00" N 86° 47' 00" W
  - Bird Fiord Formation member D
  - ***Atrypa*** sp. 97
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 6
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 2
- Section 1983A 70.0 m. (UA PCC# 92303)
  - Section 83A 70.0 meters above section base
  - 22.0 kilometers north of head of Baad Fiord
  - 76° 50' 00" N 86° 47' 00" W
  - Bird Fiord Formation member D
  - ***Atrypa*** sp. 360

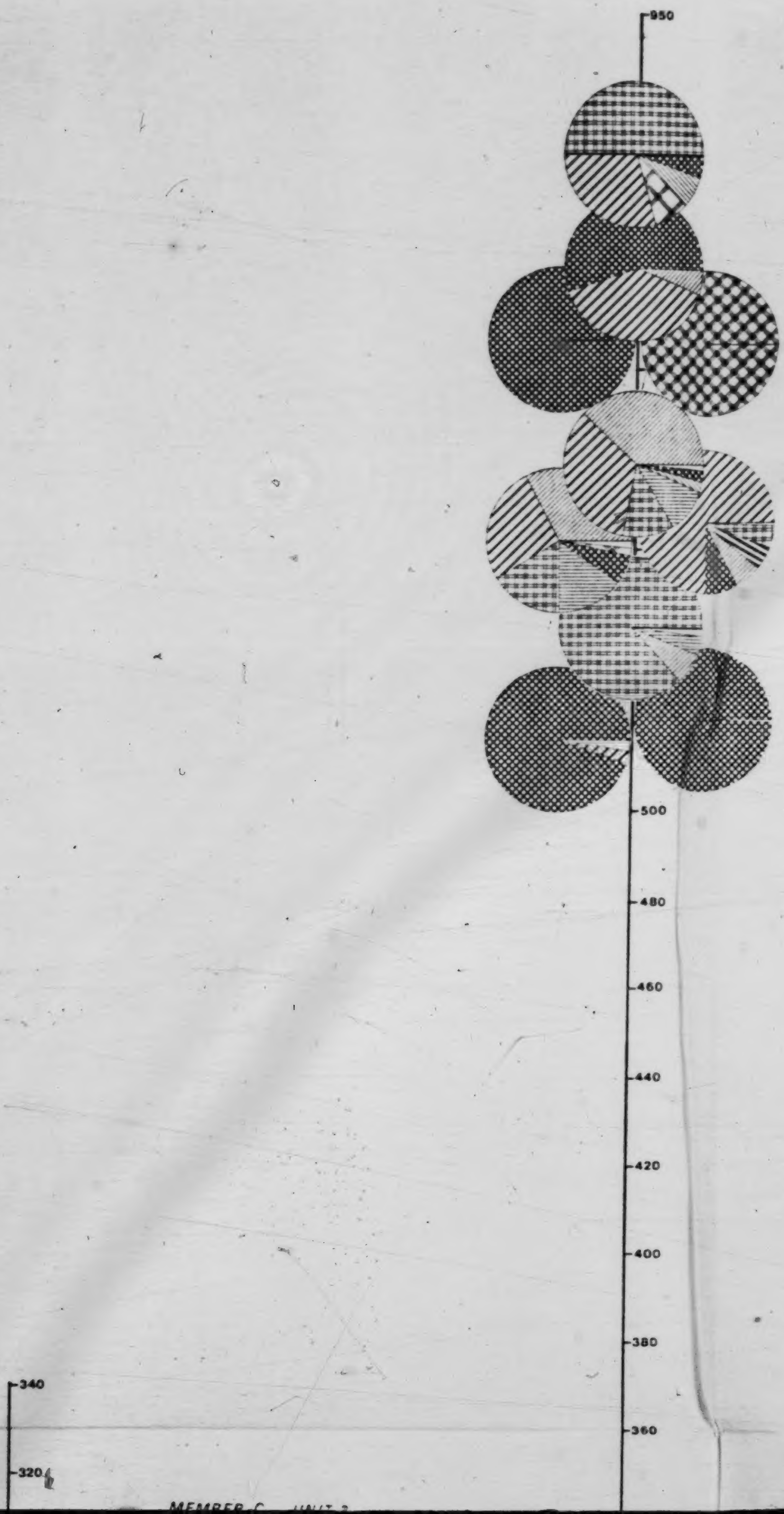
- ***Perryspirifer scheii*** Jones & Boucot (1983) 69
  - ***Schizophoria sulcata*** Johnson & Perry (1976) 10
  - ***Phragmostrophia latior?*** 2
  - 'Rhynchonellid' sp. 1
- Section 1981E 35 m. (UA PCC# 92006) Section 81E 35.0 meters above base
  - North shore, near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 1
  - ***Emanuella?*** sp. 53
  - ***Spinulicosta*** sp. 39
  - ***Atrypa*** sp. 35
- Section 1981E 45 m. (UA PCC# 92007)
  - Section 81E 45.0 meters above base
  - North shore, near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 1
  - ***Atrypa*** sp. 588
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 31
  - ***Spinatrypa (S.) borealis*** (Warren, 1944) 20
  - ***Phragmostrophia latior?*** 9
  - ***Emanuella?*** sp. 1
- Section 1981E 374 m. (UA PCC# 92010)
  - Section 81E 374.0 meters above section base
  - North shore, near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 4
  - ***"Elythyna" sverdrupi*** Brice (1982) 67
  - ***Phragmostrophia latior?*** 7
- Section 1981E 394 m. (UA PCC# 92012)
  - Section 81E 394.0 meters above base
  - North shore, near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 4
  - ***"Elythyna" sverdrupi*** Brice (1982) 127
  - ***Atrypa*** sp. 1
- Section 1981E 398 m. (UA PCC# 92103)
  - Section 81E 398.0 meters above section base
  - North shore, near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 4
  - ***"Elythyna" sverdrupi*** Brice (1982) 200
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 15
  - ***Phragmostrophia latior?*** 7
  - ***Atrypa*** sp. 6
  - ***Emanuella?*** sp. 2
  - ***Costacranaena marlenae*** Johnson & Perry (1976) 2
- Section 1981E 404 m. (UA PCC# 92047)
  - Section 81E 404.0 meters above base
  - North shore, near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W
  - Bird Fiord Formation member F unit 4
  - ***Atrypa*** sp. 152
  - ***"Elythyna" sverdrupi*** Brice (1982) 116
  - ***Cupularostrum repetitor*** Johnson & Perry (1976) 4
  - ***Phragmostrophia latior?*** 2
  - ***Perryspirifer scheii*** Jones & Boucot (1983) 2
  - ***Spinulicosta*** sp. 1
  - ***Nucleospira*** sp. 1
- Section 1981E 418.25 m. (UA PCC# 92408)
  - Section 81E 418.25 meters above base
  - North shore, near mouth of Bird Fiord
  - 77° 12' 30" N 87° 02' 00" W

Bird Fiord Formation member F unit 4
Spinatrypa* (*S.*) *borealis (Warren, 1944) 330
Nucleospira sp. 91
"***Elythyna*" *sverdrupi*** Brice (1982) 41
Cupularostrum repetitor Johnson & Perry (1976) 21
Phragmostrophia latior? 11
Spinulicosta sp. 4
Atrypa sp. 3
Costacranaena marlenae Johnson & Perry (1976) 2

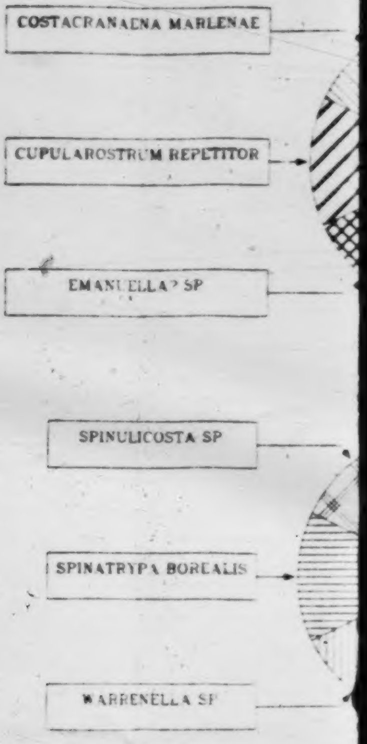
Section 1981F 140 m. (UA PCC# 92221)
Section 81F 140.0 meters above section base
North shore, central Bird Fiord
77° 11' 30" N 86° 44' 00" W
Bird Fiord Formation member F unit 5
"***Elythyna*" *sverdrupi*** Brice (1982) 171
Nucleospira sp. 44
Atrypa sp. 40
Cupularostrum repetitor Johnson & Perry (1976) 10
Phragmostrophia latior? 4
Schizophoria sulcata Johnson & Perry (1976) 3

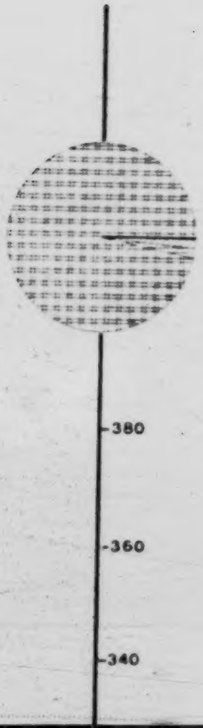
Section 1981F 206 m. (UA PCC# 92222)
Section 81F 206.0 meters above section base
North shore, central Bird Fiord
77° 11' 30" N 86° 44' 00" W
Bird Fiord Formation member F unit 5
Atrypa sp. 703
Perryspirifer scheii Jones & Boucot (1983) 153
"***Elythyna*" *sverdrupi*** Brice (1982) 56
Nucleospira sp. 20
Phragmostrophia latior? 5
Schizophoria sulcata Johnson & Perry (1976) 3

1oF

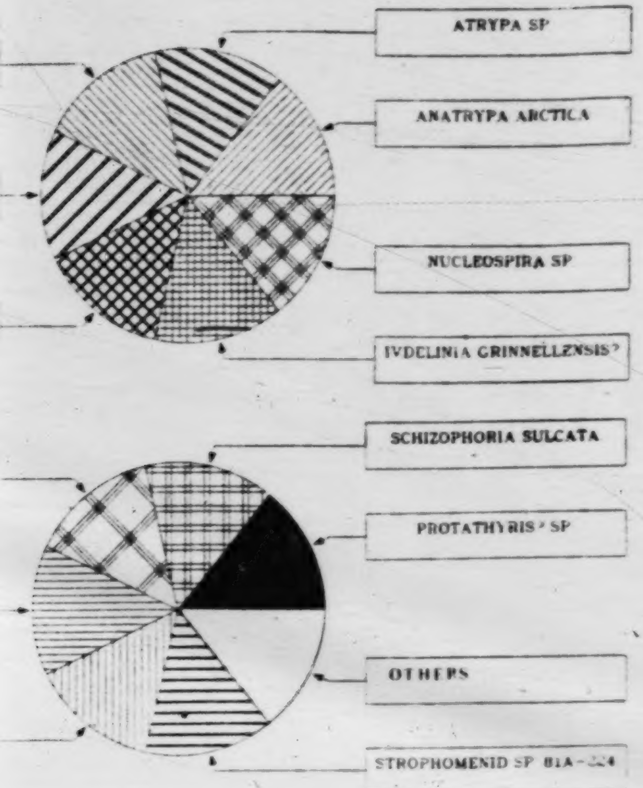


20F

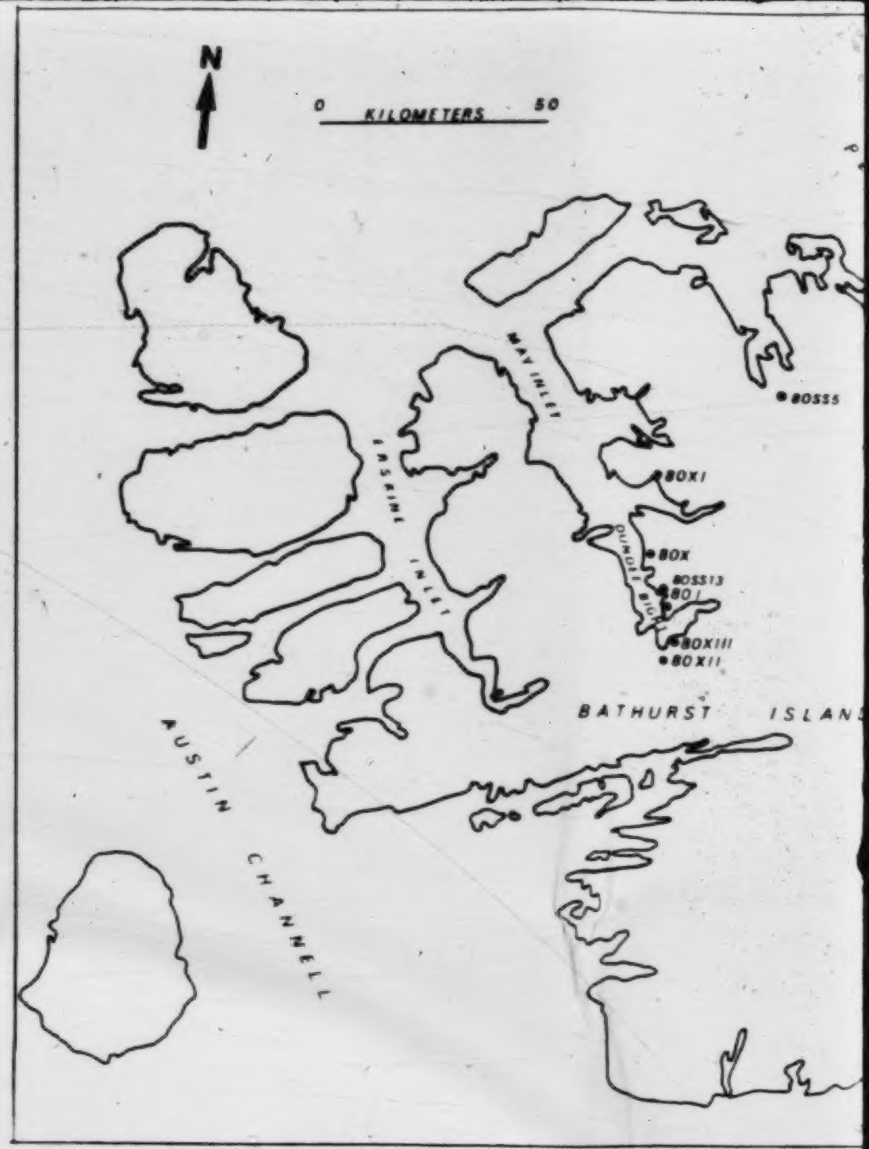

COSTACRANAENA MARLENAE
CUPULAROSTRUM REPETITOR
EMANUELLA? SP
SPINULICOSTA SP
SPINATRYPA BOREALIS
WARRENELLA SP


380
360
340

30F



KEY


N
0 KILOMETERS 50
MAY INLET
ERSKINE INLET
DUNDEE BIGHT
80SS5
80XI
80X
80SS13
80I
80XIII
80XII
BATHURST ISLAN
AUSTIN CHANNELL

TEXT FIGU

BRACHIOPOD ASSEMBLAGE

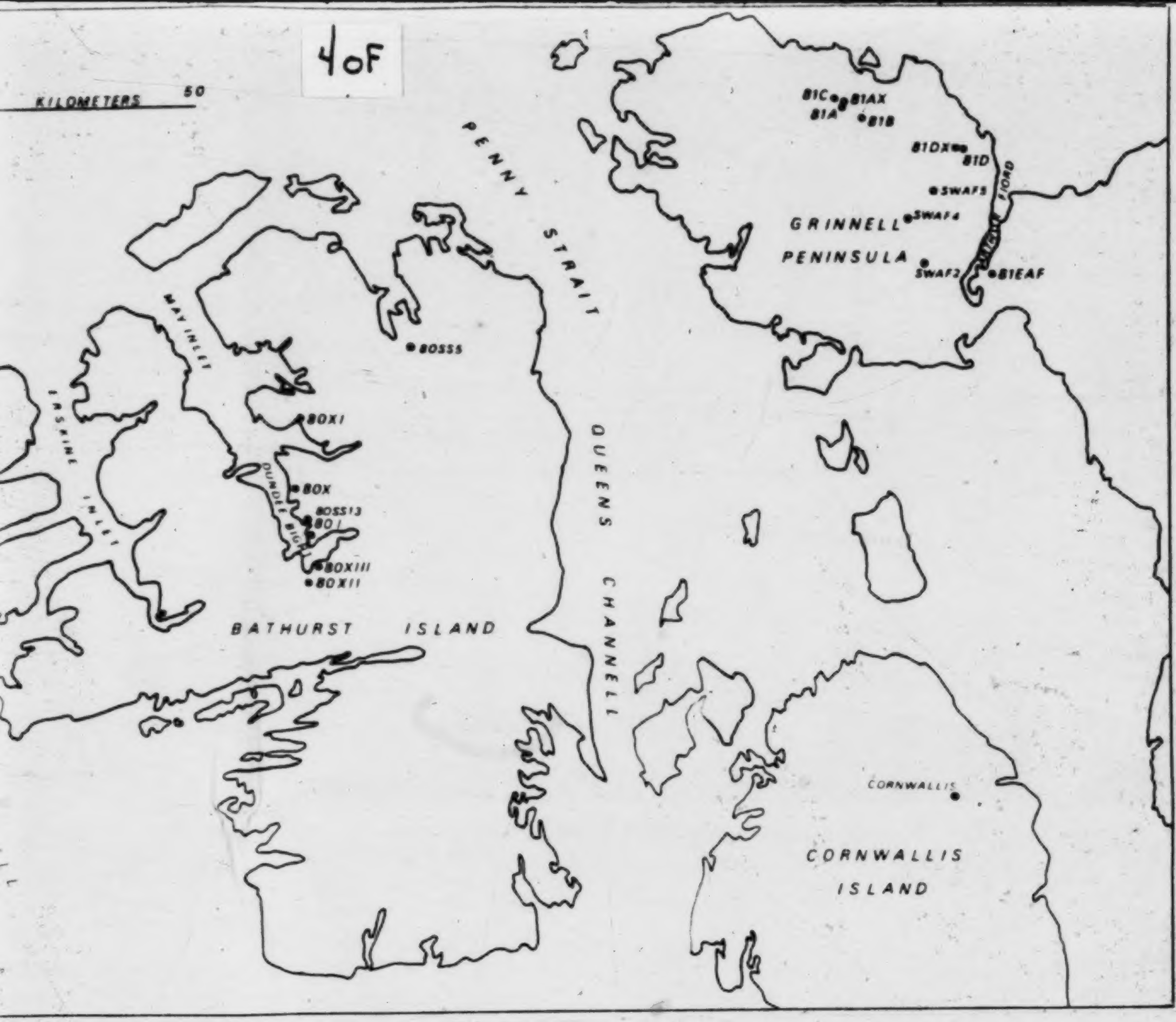
BIRD FIORD F

AND

BIRD FIORD FORMATION C

BATHURST ISLAND AND

4oF


KILOMETERS 50
PENNY STRAIT
MAY INLET
ERSKINE INLET
80SS5
80XI
80X
DUNDEE BIGHT
80SS13
80I
80XIII
80XII
BATHURST ISLAND
QUEENS CHANNELL
81C
81AX
81A
81B
81DX
81D
SWAF5
SWAF4
SWAF2
81EAF
FIORD
GRINNELL PENINSULA
CORNWALLIS
CORNWALLIS ISLAND

TEXT FIGURE 8.1

RACHIOPOD ASSEMBLAGES AT SAMPLE LOCALITIES

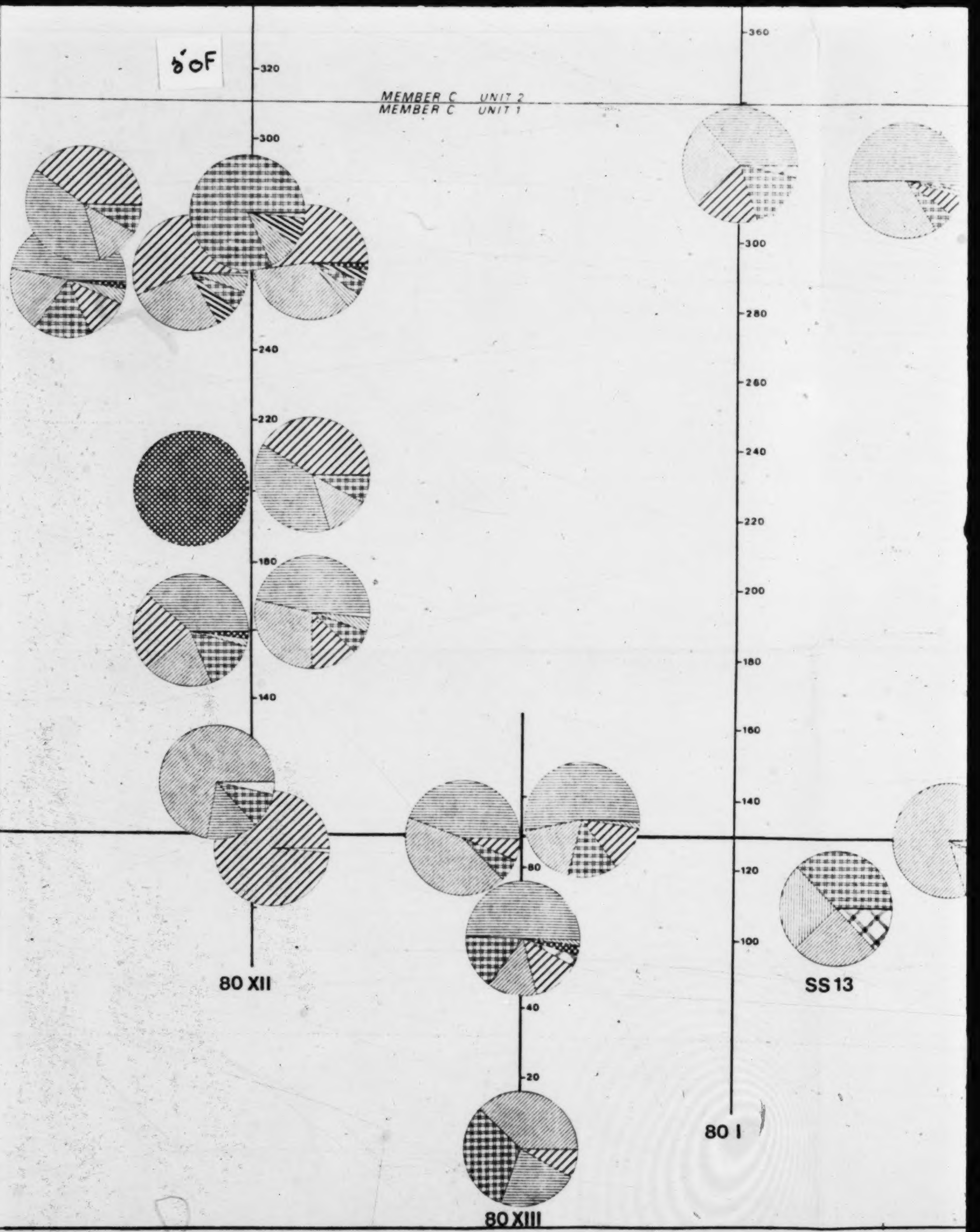
BIRD FIORD FORMATION

AND

BIRD FIORD FORMATION CARBONATE EQUIVALENT

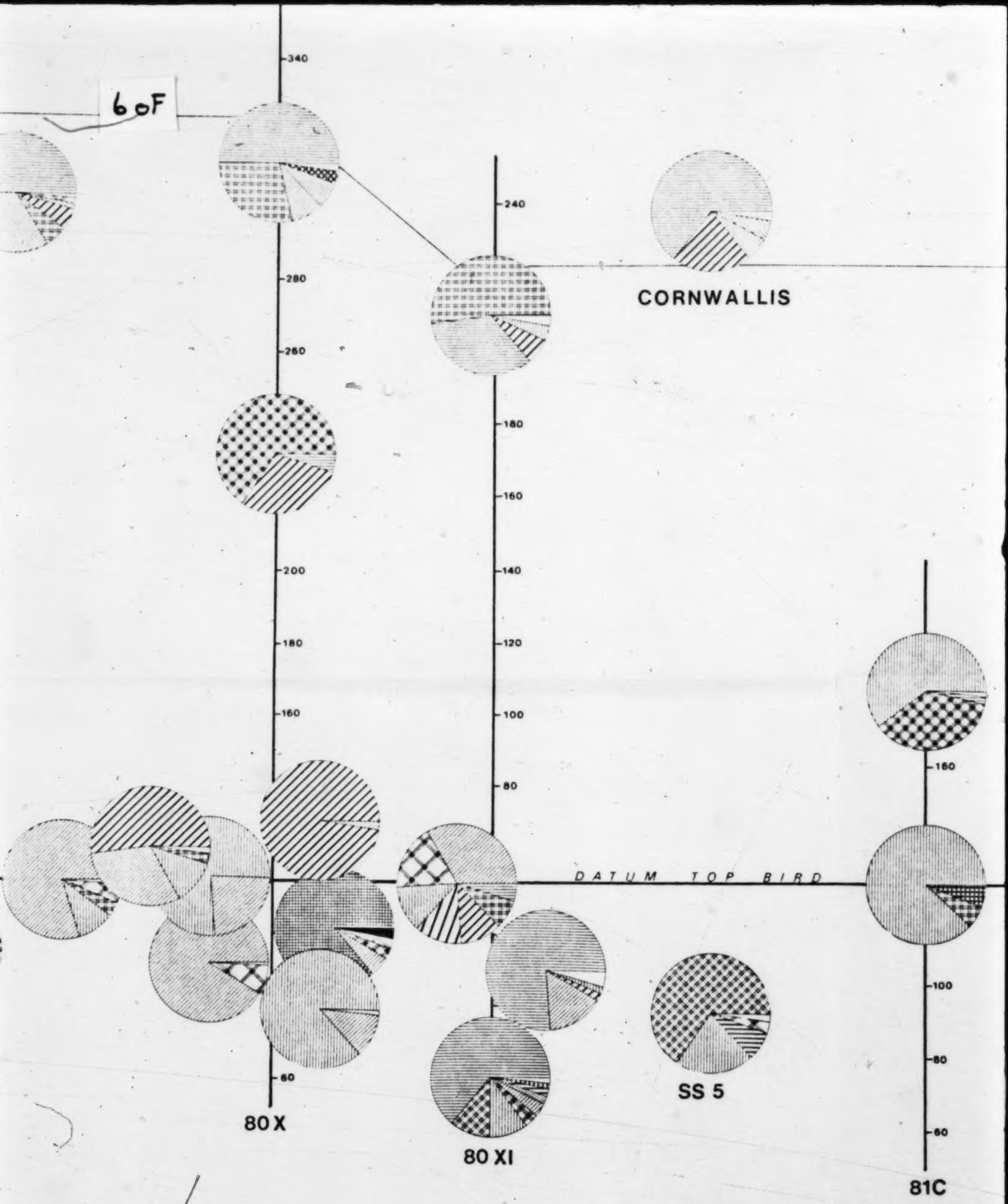
BATHURST ISLAND AND GRINNELL PENINSULA

3'OF



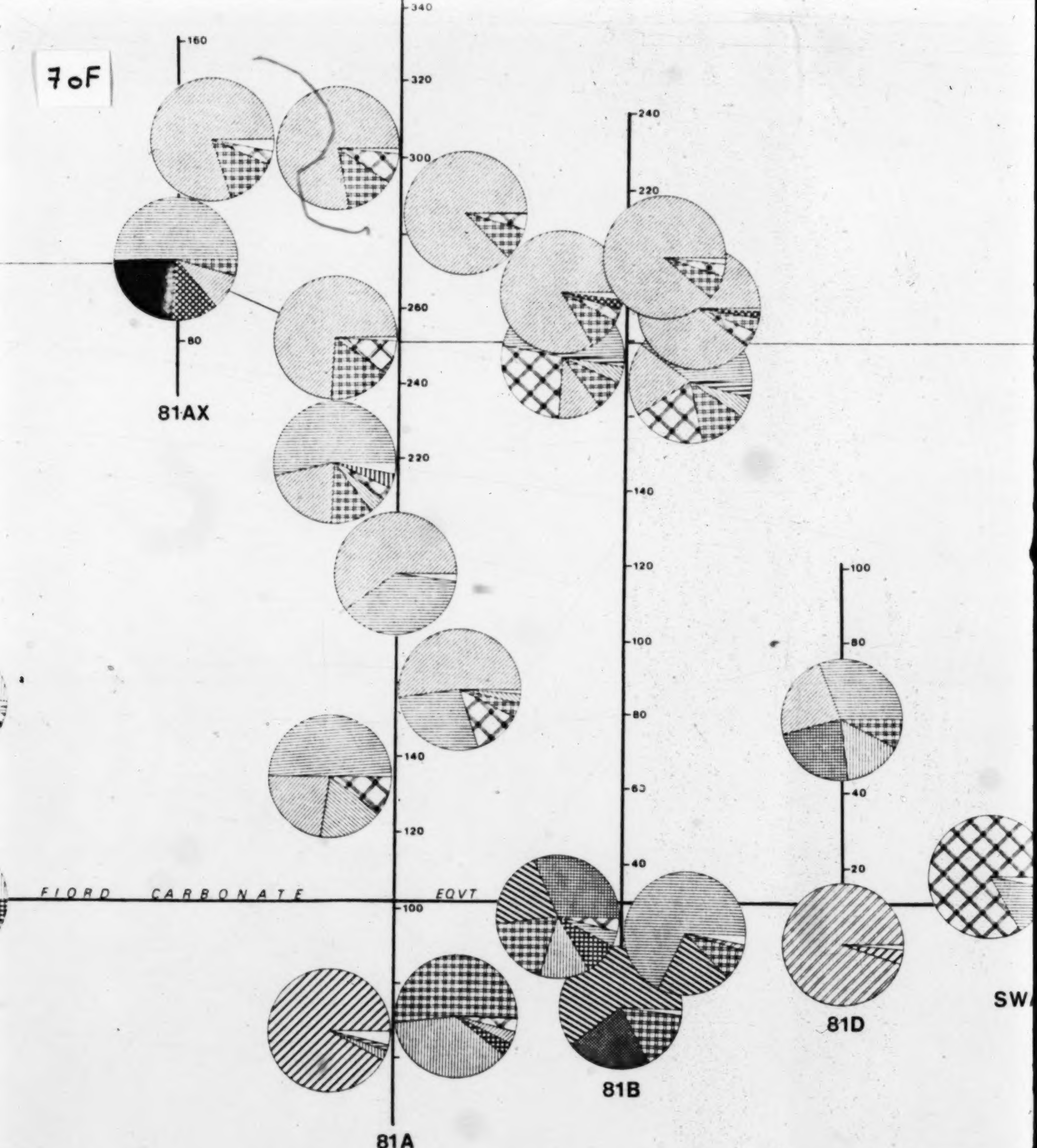
MEMBER C UNIT 2
MEMBER C UNIT 1
320
300
240
220
180
140
80 XII
80
40
20
80 XIII
360
300
280
260
240
220
200
180
160
140
120
100
80 I
SS 13

6oF



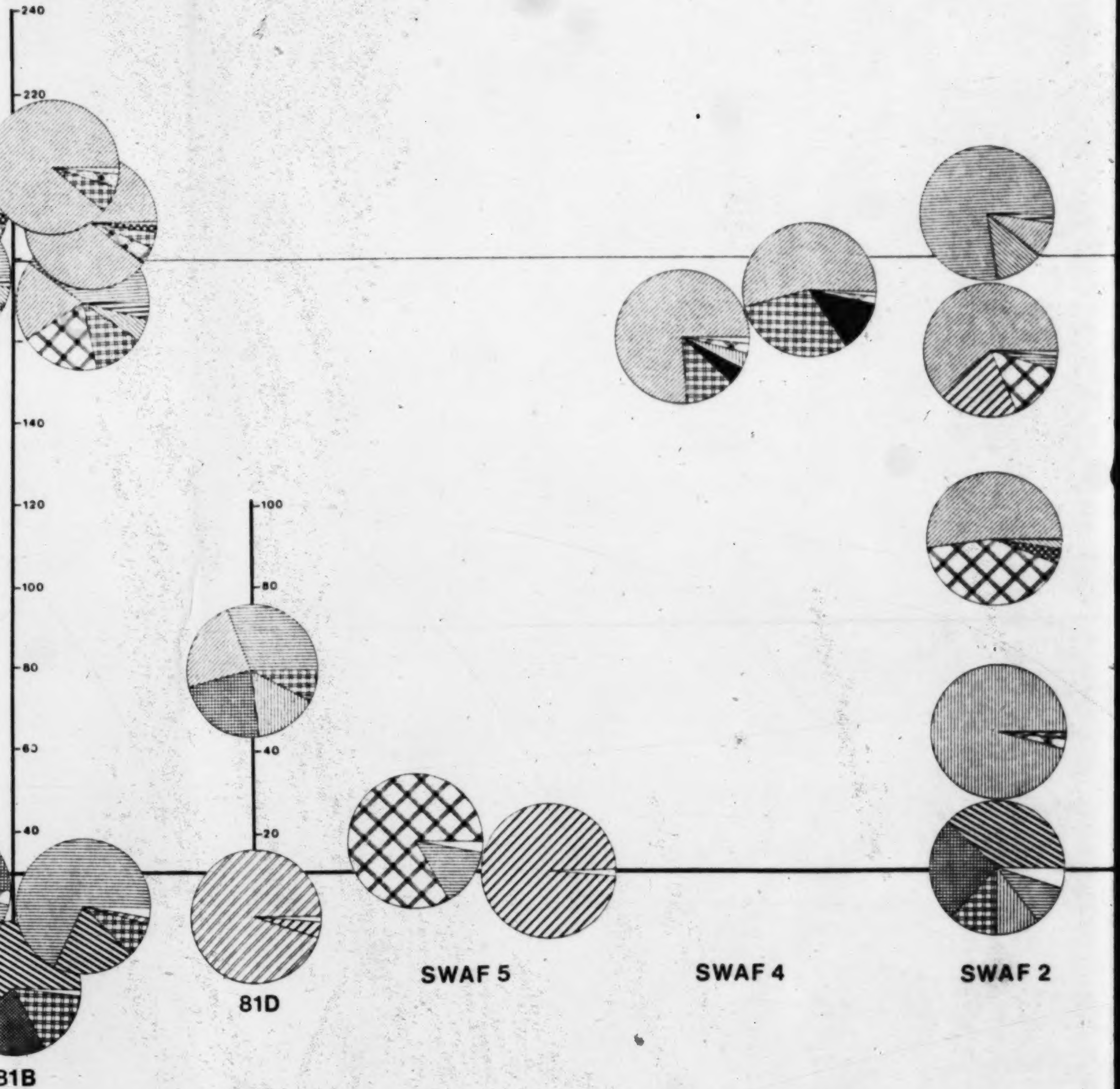
340
280
260
200
180
160
60
80 X
240
180
160
140
120
100
80
80 XI
CORNWALLIS
DATUM TOP BIRD
SS 5
160
100
80
60
81C

7oF



160
80
81AX
340
320
300
260
240
220
140
120
100
81A
240
220
140
120
100
80
60
40
81B
100
80
40
20
81D
FIORD CARBONATE EQVT
SW

8oF



SEE APPENDIX 4

1oF

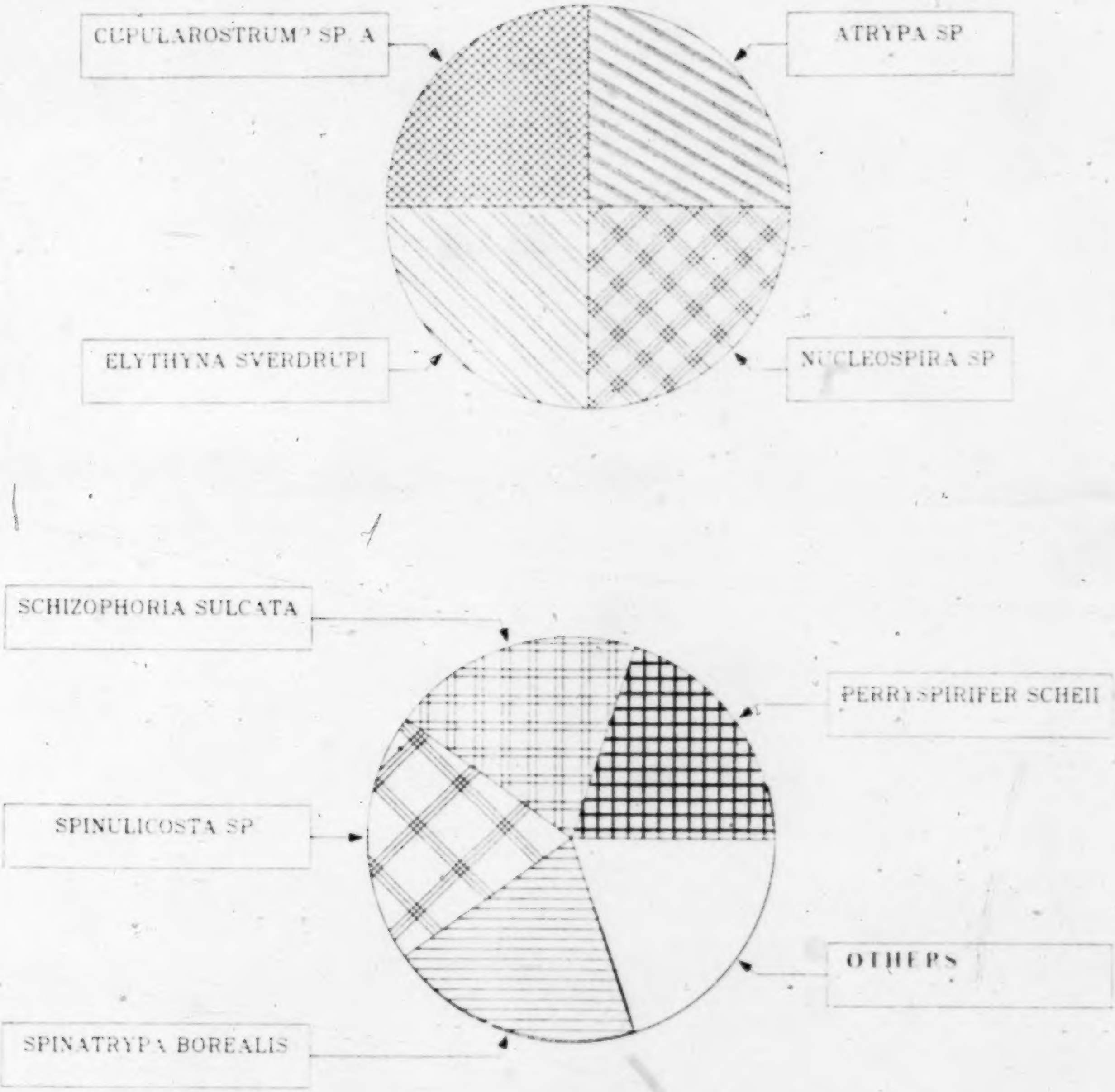
BIRD FIORD FORMATION
BRACHIOPOD ASSEMBLAGES

SAMPLE LOCALITIES NORTH DEVON ISLAND,
NORTH KENT ISLAND
AND
S.W. ELLESMERE ISLAND (SOUTH OF SCHEI SYNCLINE AXIS)

TEXT FIGURE 8.2

2oF

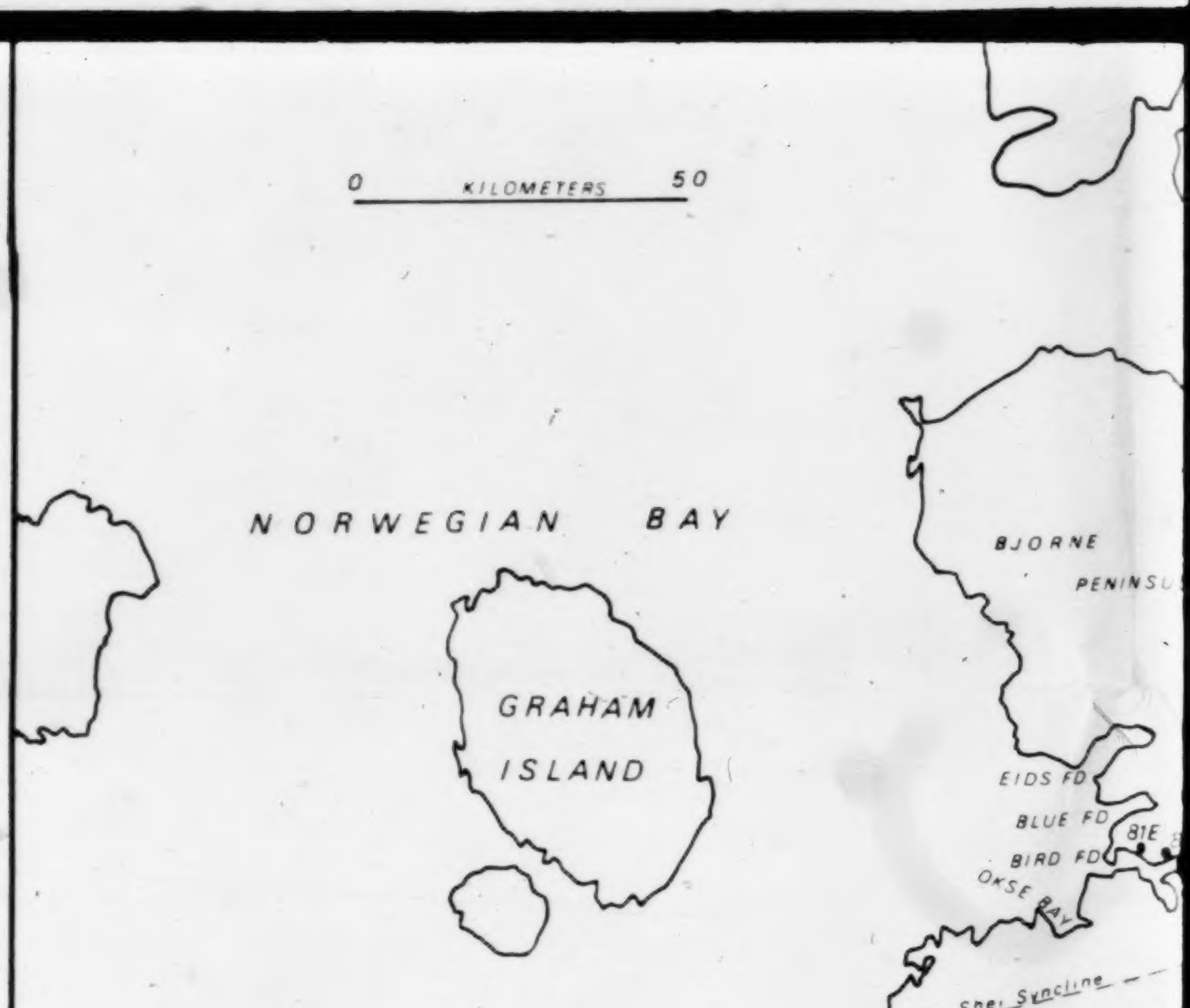
IS)


CUPULAROSTRUM? SP. A
ATRYPA SP
ELYTHYNA SVERDRUPI
NUCLEOSPIRA SP
SCHIZOPHORIA SULCATA
PERRYSPIRIFER SCHEII
SPINULICOSTA SP
OTHERS
SPINATRYPA BOREALIS

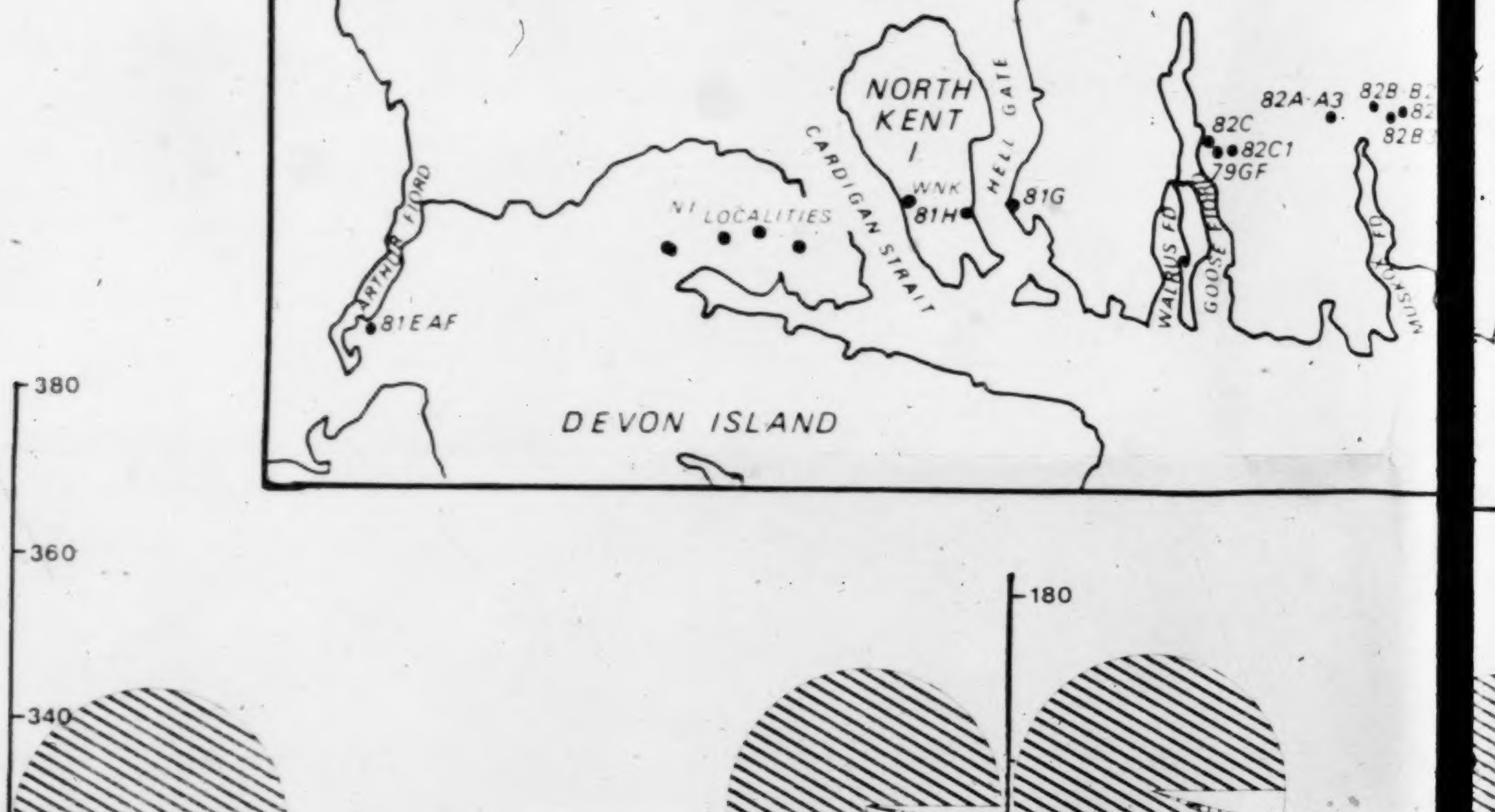
KEY

440
420

30F

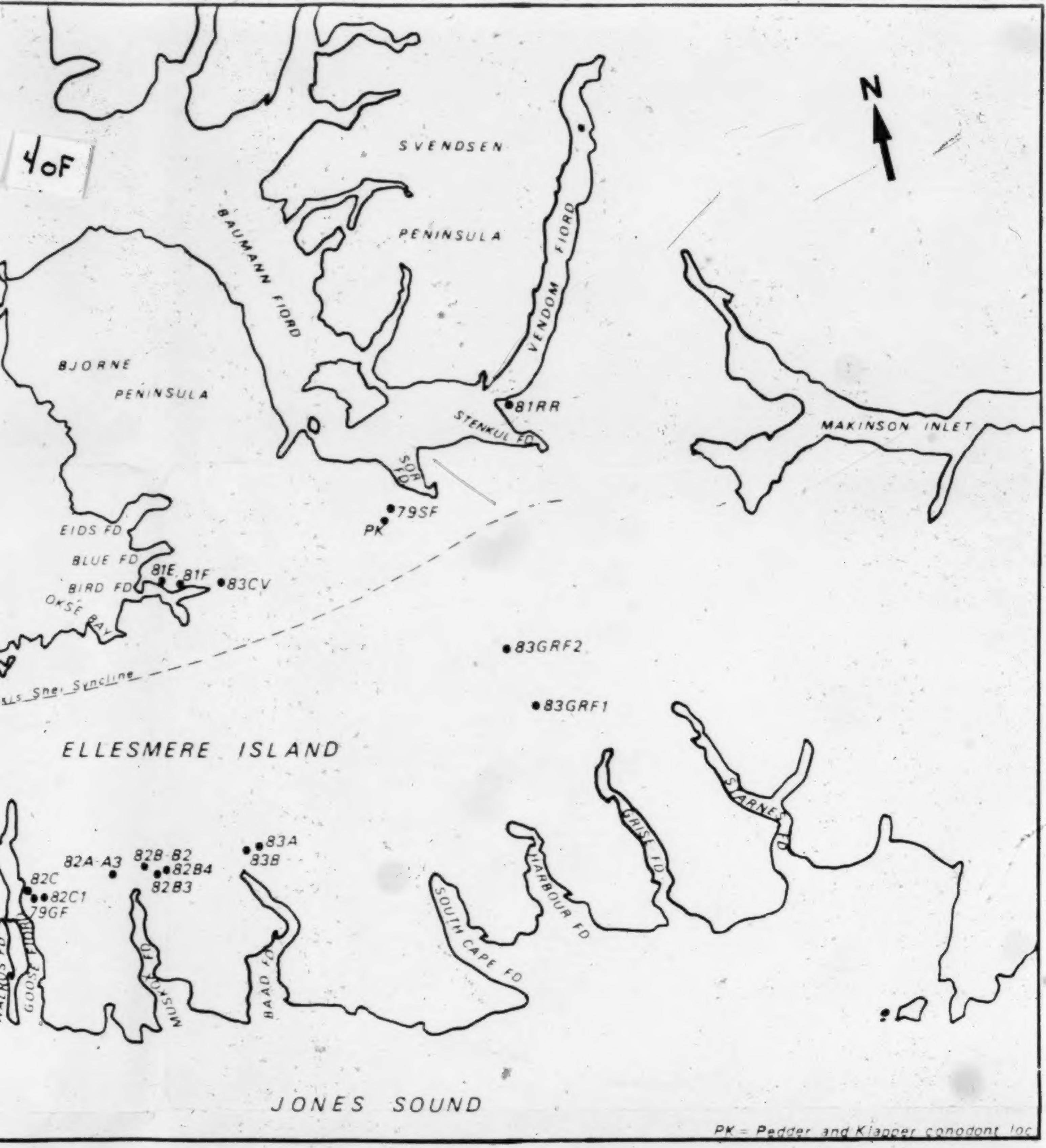


0 KILOMETERS 50
NORWEGIAN BAY
GRAHAM ISLAND
BJORNE
PENINSU
EIDS FD
BLUE FD
81E
BIRD FD
OKSE BAY
axis Sher Syncline
ELLESMER
82A-A3
82B B
82
82B
82C
82C1
79GF
WALRUS FD
GOOSE FIORD
MUSK OX FD
NORTH KENT I
HELL GATE
CARDIGAN STRAIT
WNK
81H
81G
NI LOCALITIES
ARTHUR FIORD
81EAF
DEVON ISLAND



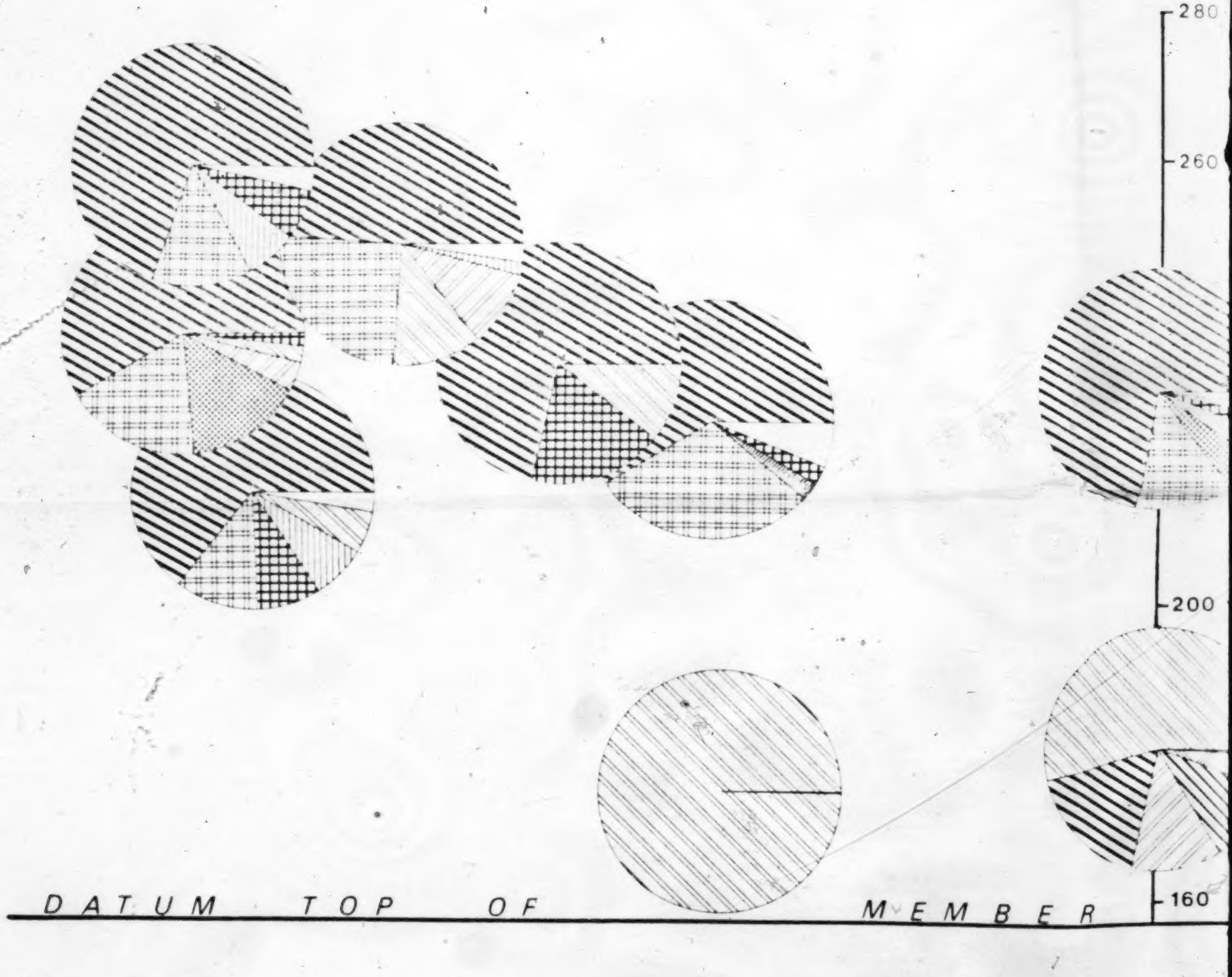
380
360
340
180

4oF


N
SVENDSEN
PENINSULA
BAUMANN FIORD
VENDOM FIORD
BJORNE
PENINSULA
STENKUL FD
SOR FD
•81RR
MAKINSON INLET
•79SF
PK
EIDS FD
BLUE FD
BIRD FD
81E
81F
•83CV
OKSE BAY
•83GRF2
•83GRF1
Sher Syncline
ELLESMERE ISLAND
83A
83B
82A-A3
82B-B2
•82B4
82B3
82C
•82C1
79GF
GOOSE FIORD
MUSKOX FD
HAAD FD
SOUTH CAPE FD
HARBOUR FD
GRISE FD
S. ARNE FD
JONES SOUND

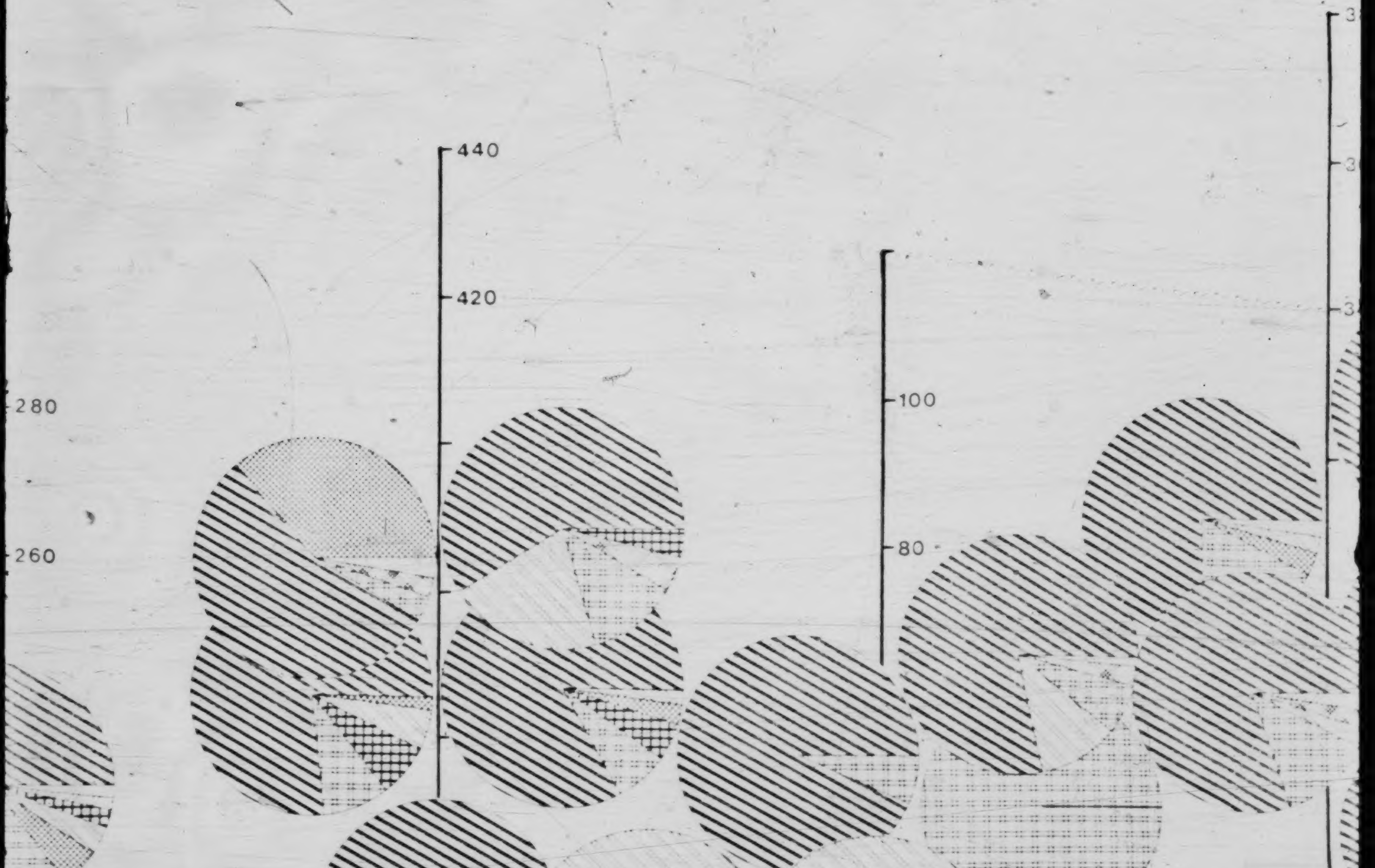
PK = Pedder and Klapper conodont loc

8 OF

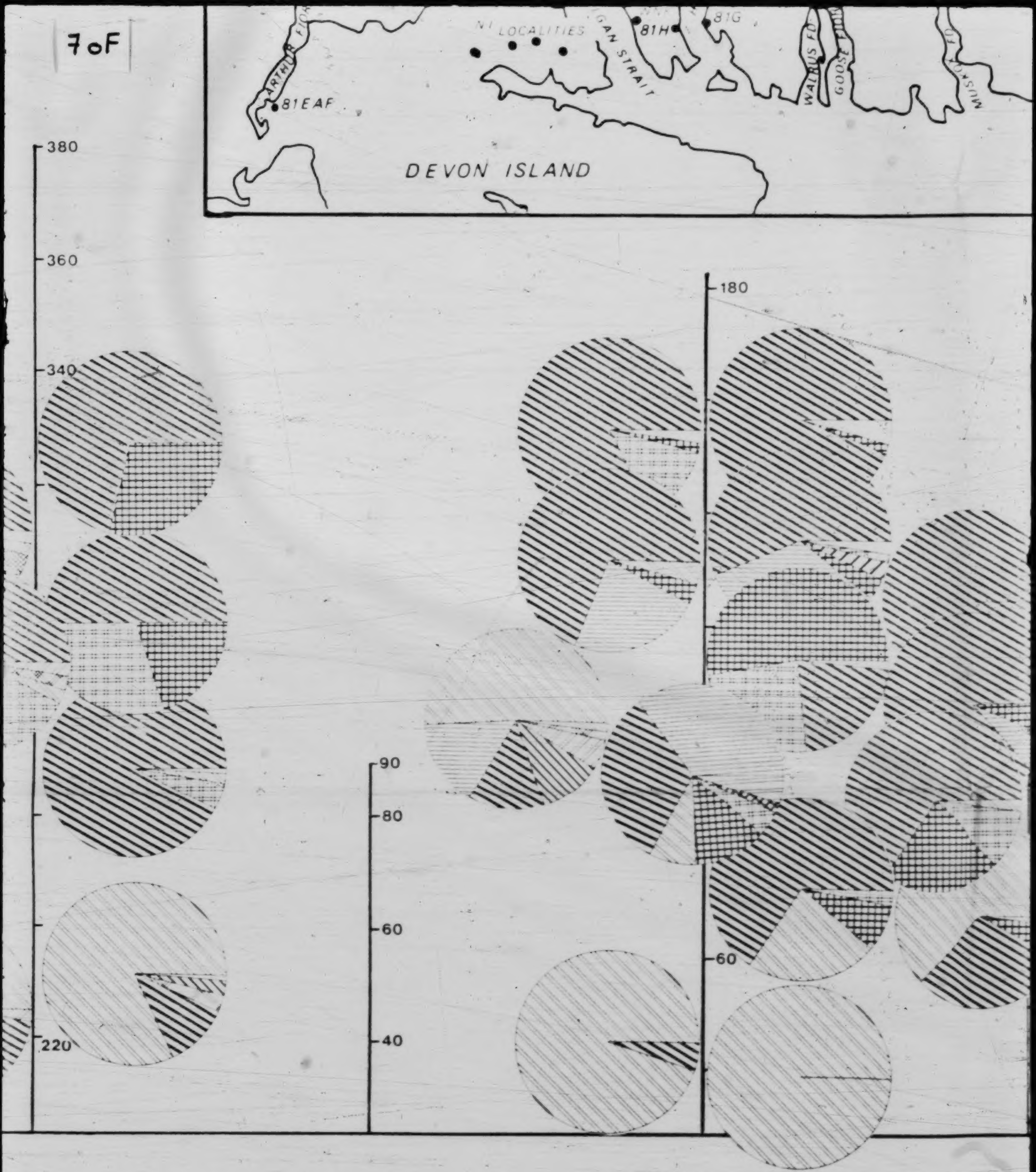


6oF

KEY



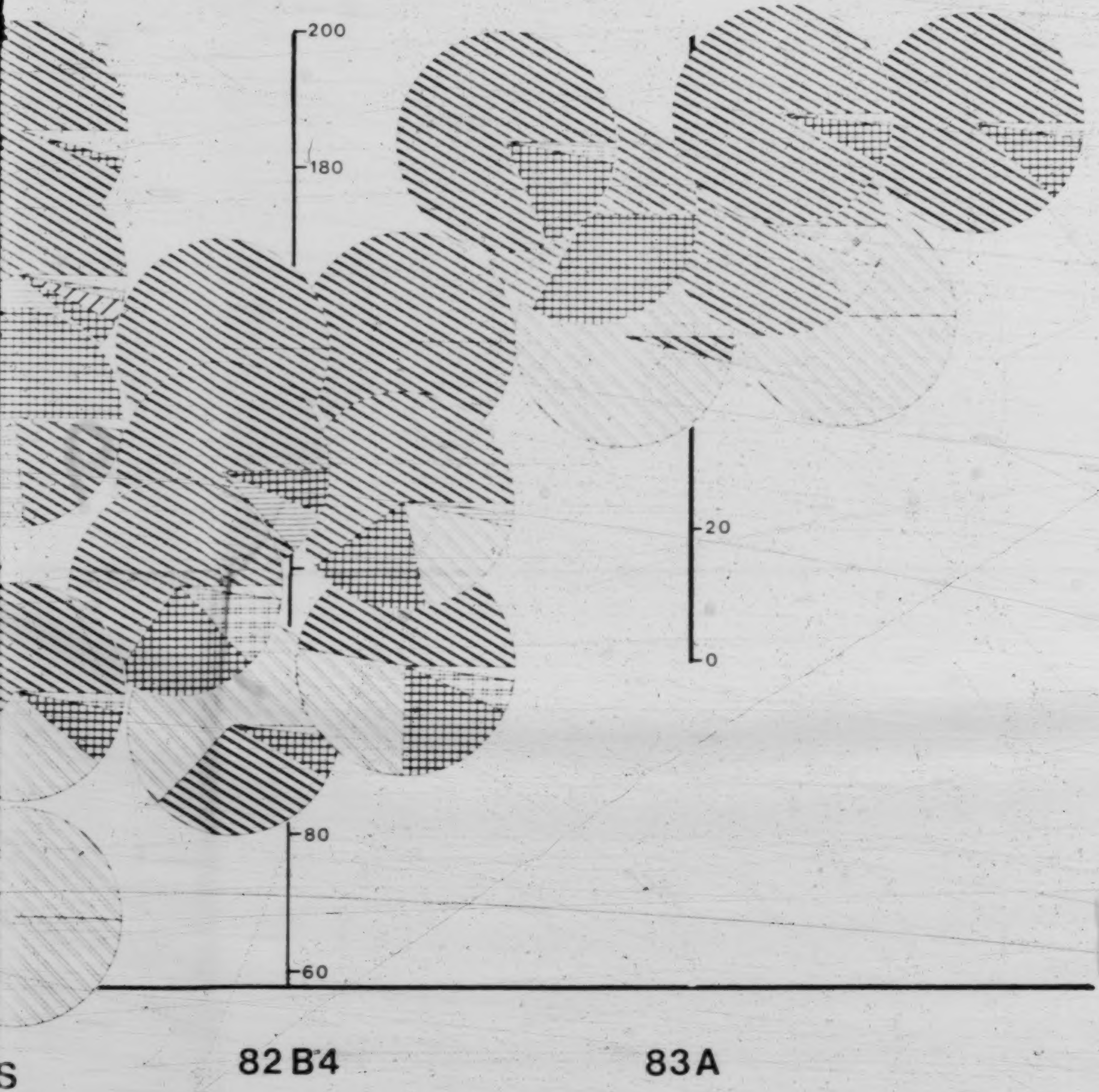
7oF



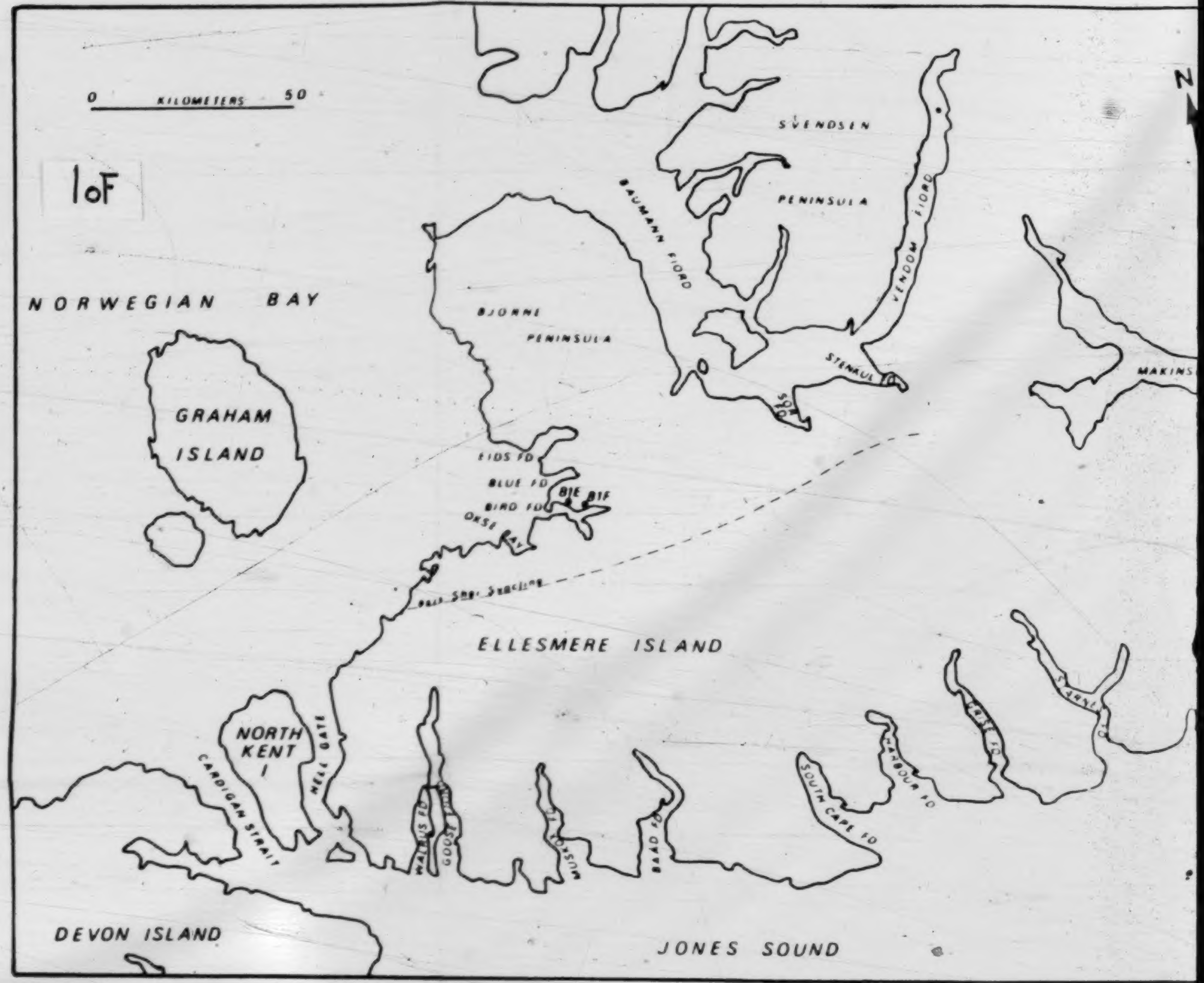
ARTHUR FIORD
81EAF
NI LOCALITIES
IGAN STRAIT
81H
81G
WALRUS FD
GOOSE FIORD
MUSK OX FD
DEVON ISLAND
380
360
340
220
90
80
60
40
180
60
2 C1
82 A3
82B2/82BSS
82

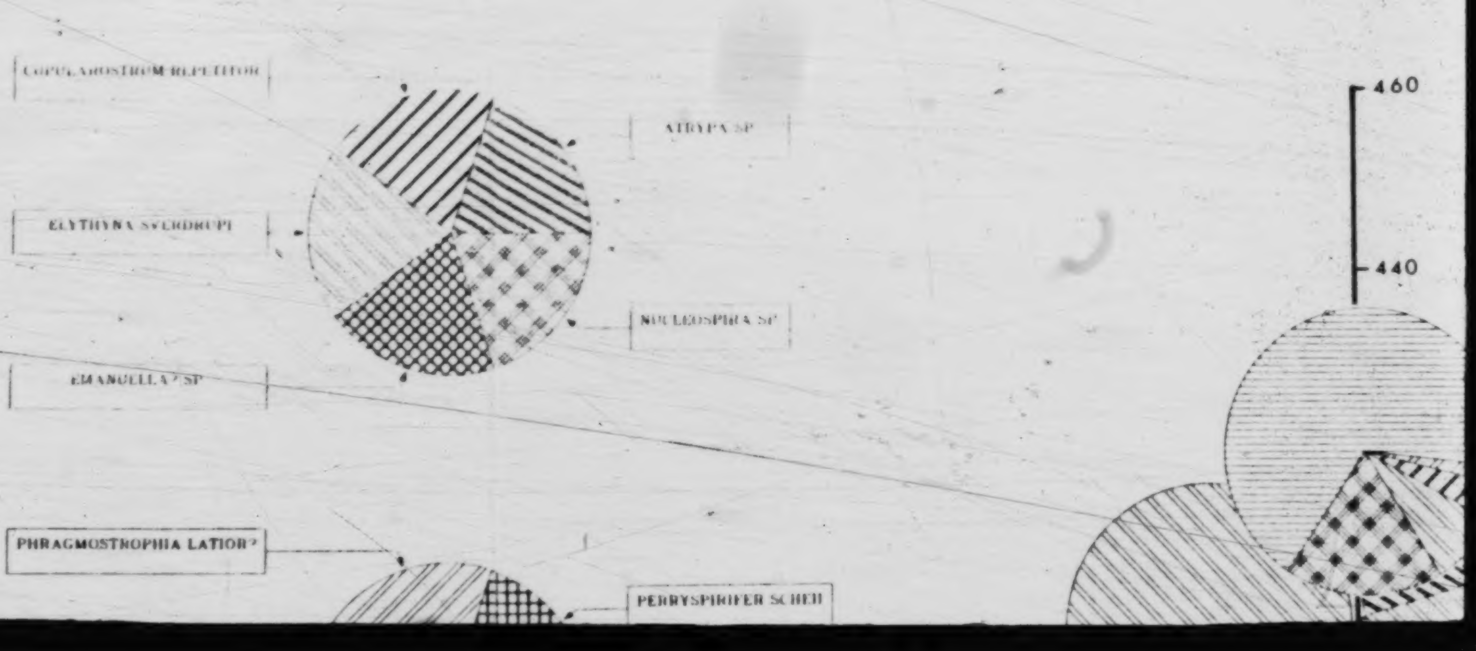
WALRUS FD
GOOSE FIORD
MUSKOX FD
BAAD FD
CAPE FD
JONES SOUND
PK = Pedder and Klapper conodont loc

8 of 8

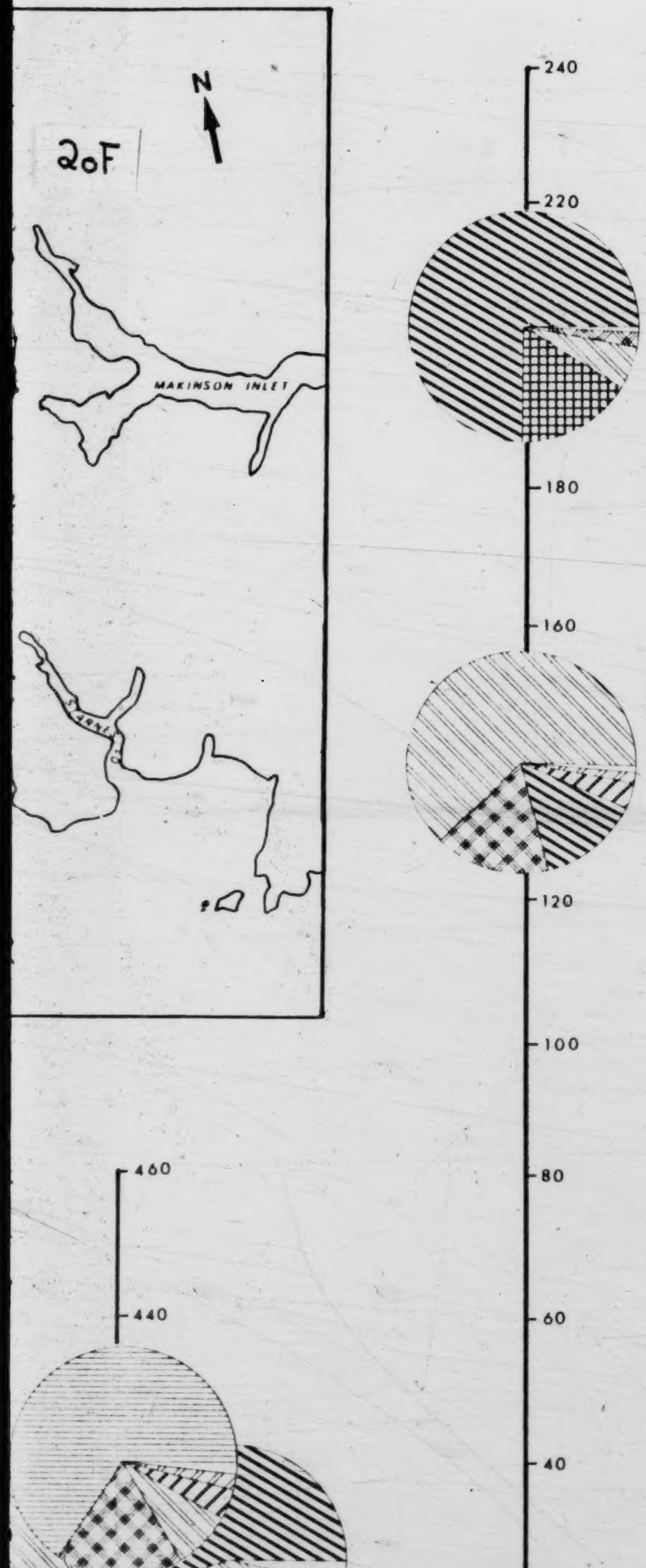


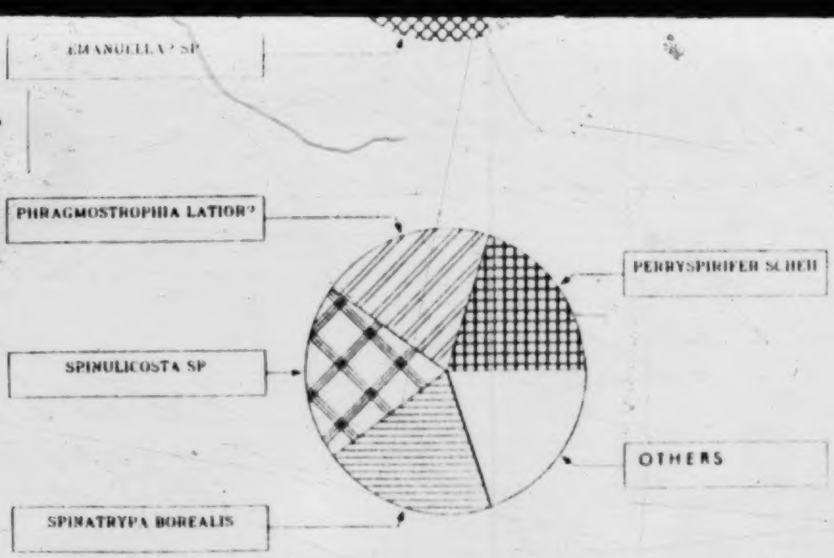
SEE APPENDIX 4


0 KILOMETERS 50
1oF
N
NORWEGIAN BAY
GRAHAM ISLAND
BJORNE PENINSULA
BAUMANN FIORD
SVENDSEN PENINSULA
VENDOM FIORD
STENKUL FD
MAKINS
EIDS FD
BLUE FD
BIRD FD
OKSE BAY
BIE
BIF
ELLESMERE ISLAND
NORTH KENT I
CARDIGAN STRAIT
HELL GATE
WALRUS FD
GOOSE FD
MUSKOX FD
BAAD FD
SOUTH CAPE FD
HARBOUR FD
DEVON ISLAND
JONES SOUND

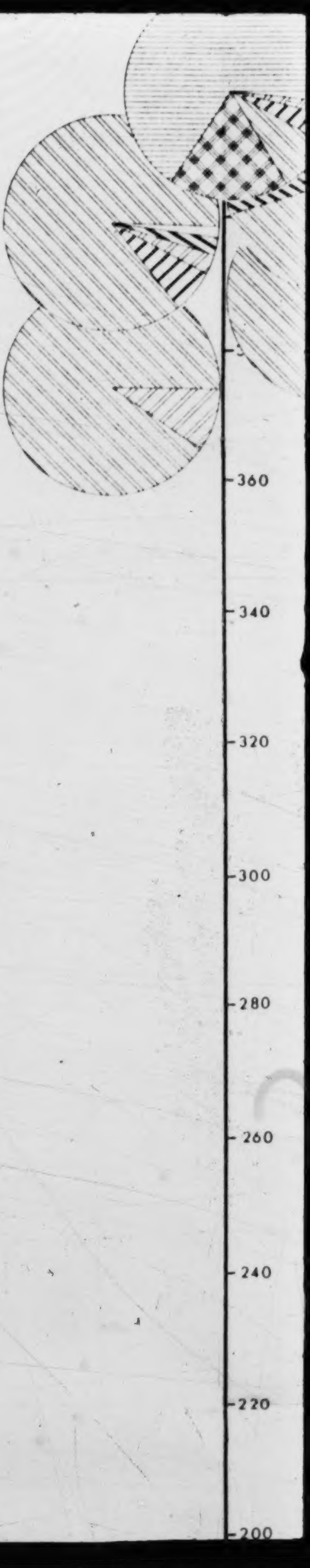

COPULAROSTRUM REPETITOR
ATRYPA SP
ELYTHYNA SVERDRUPI
NUCLEOSPIRA SP
EMANUELLA ? SP
PHRAGMOSTROPHIA LATIOR ?
PERRYSPIRIFER SCHEII
460
440

2oF





KEY

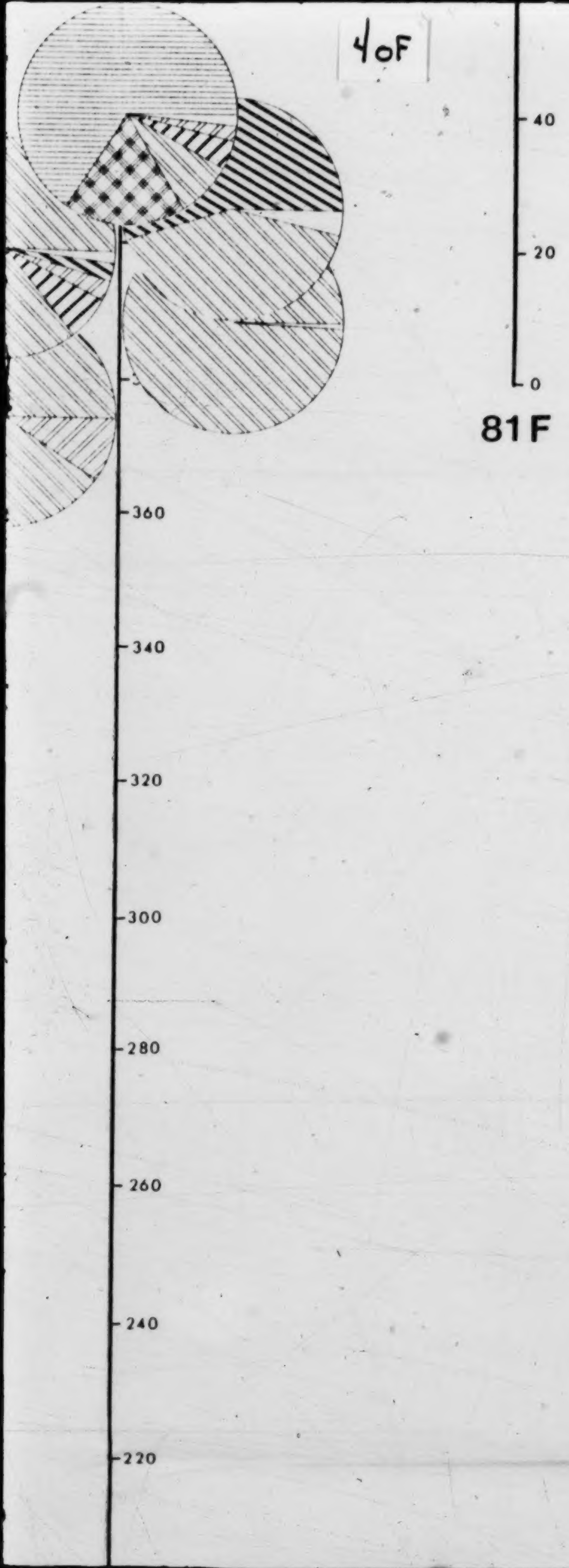


TEXT FIGURE 8.3

BIRD FIORD FORMATION
BRACHIOPOD ASSEMBLAGES
SAMPLE LOCALITIES
BIRD FIORD AREA
S.W. ELLESMERE ISLAND

(NORTH OF SCHEI SYNCLINE AXIS)

4oF



8'oF

TEXT FIGURE 8.3

BIRD FIORD FORMATION

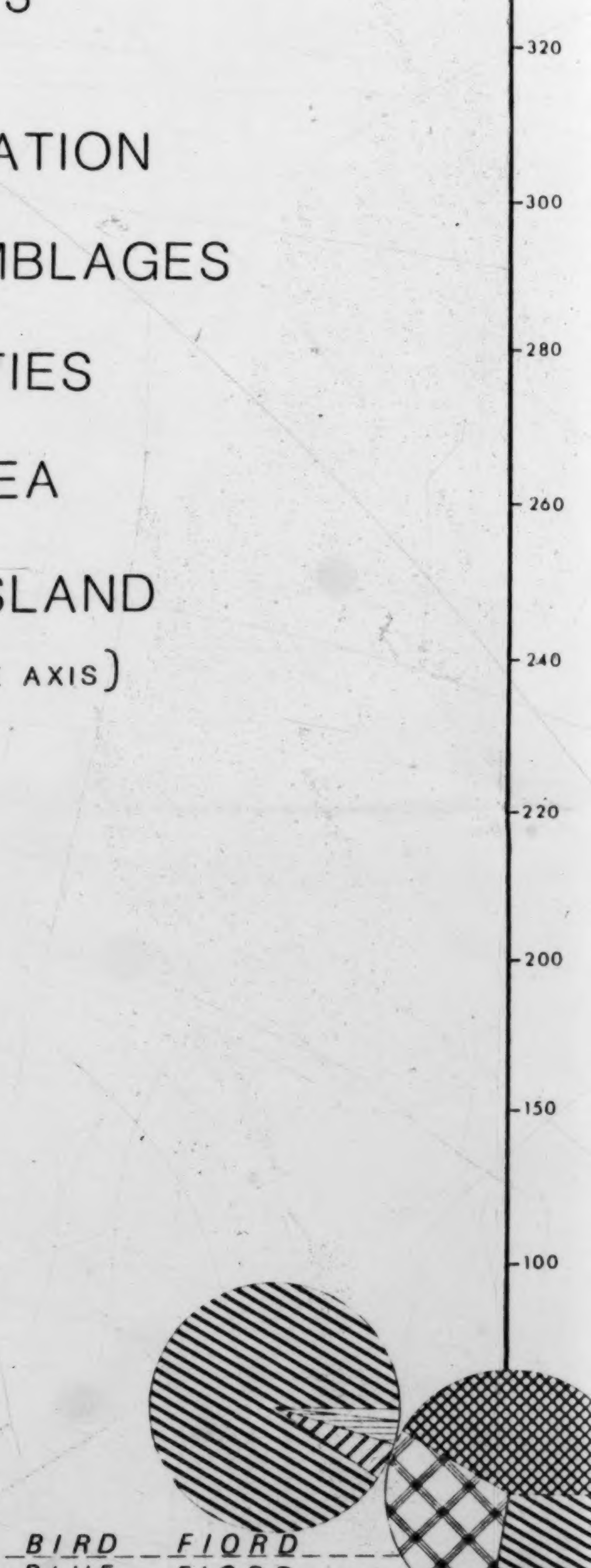
BRACHIOPOD ASSEMBLAGES

SAMPLE LOCALITIES

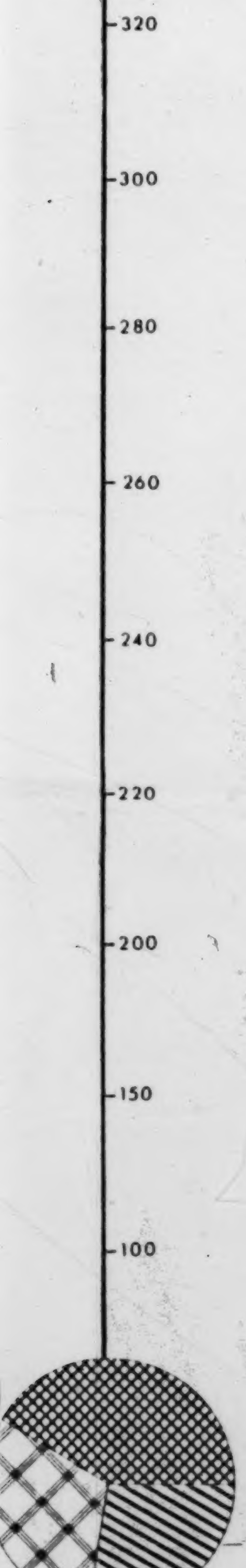
BIRD FIORD AREA

S.W. ELLESMERE ISLAND

(NORTH OF SCHEI SYNCLINE AXIS)


320
300
280
260
240
220
200
150
100
BIRD FIORD
BLUE FIORD
81E

6 of 6



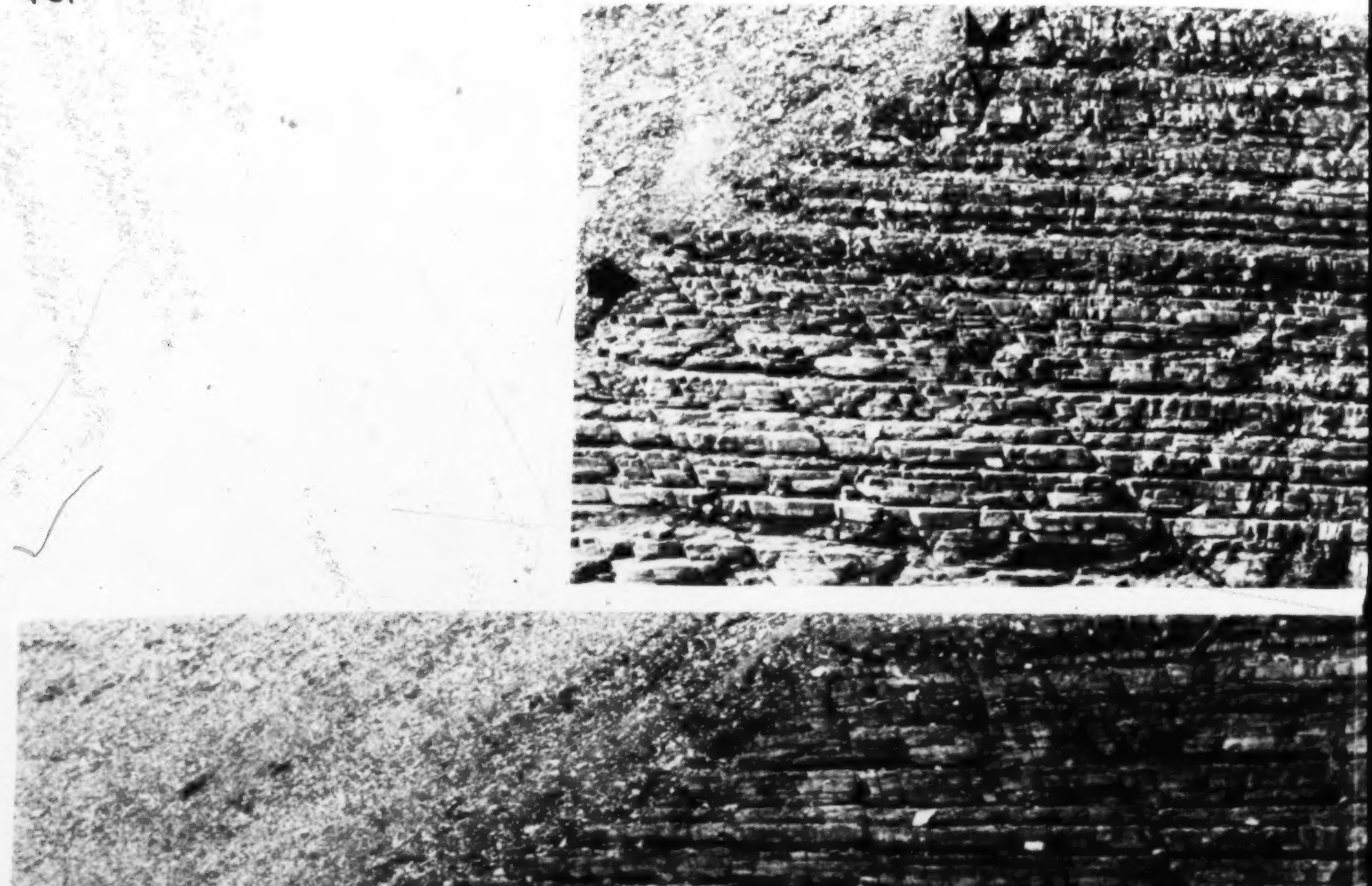
FORMATION

FORMATION

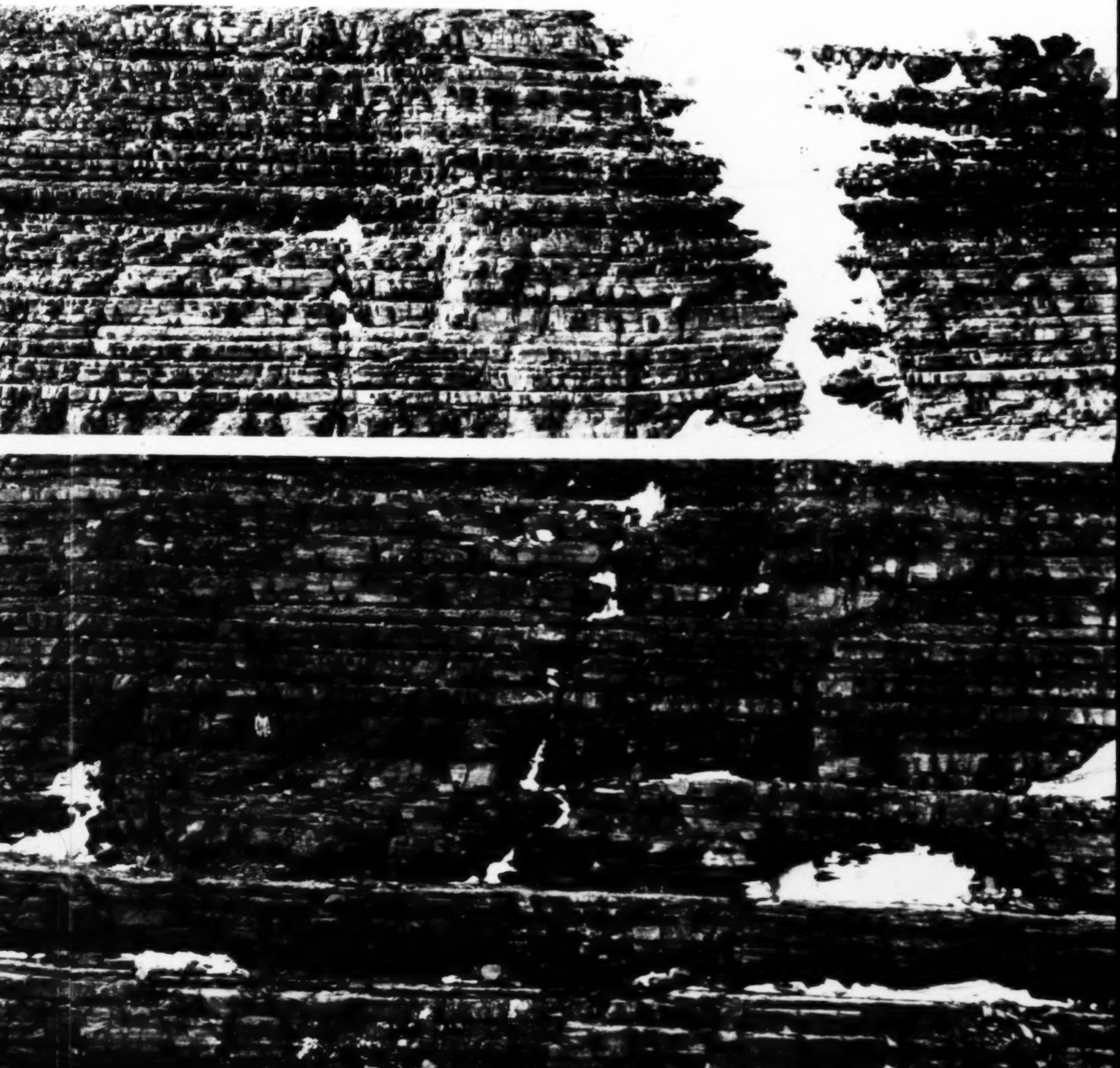
81E

SEE APPENDIX 4

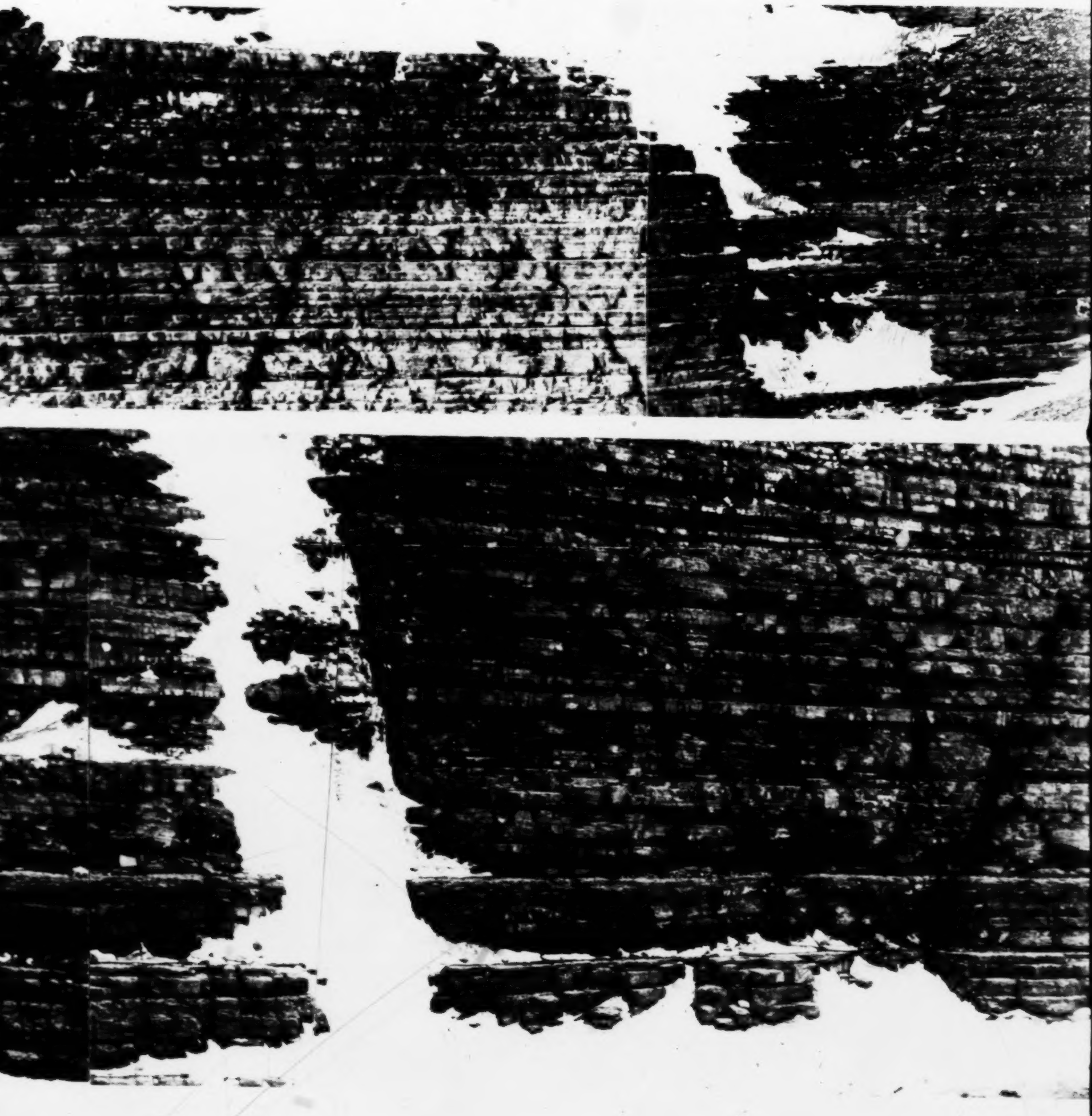
10F

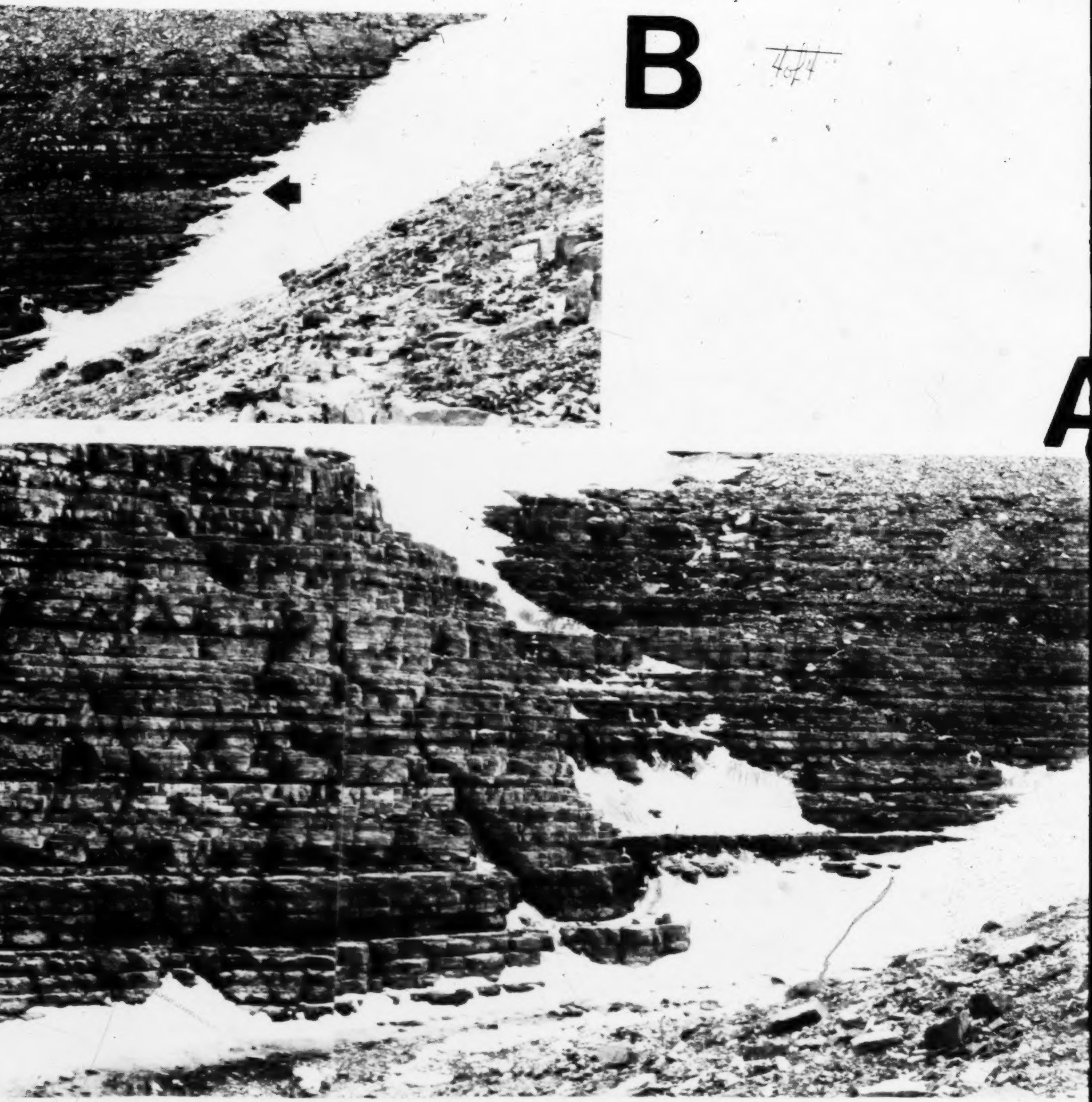


20F



30F

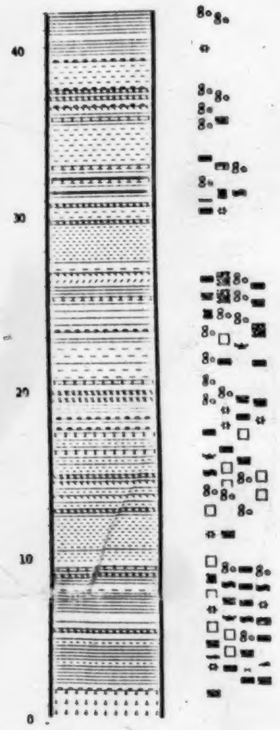




4of4

1983 GRISE FIORD 1, APPROX 10 MILES N.W. OF HEAD OF GRISE FIORD

76 57 30 N 84 03 00 W



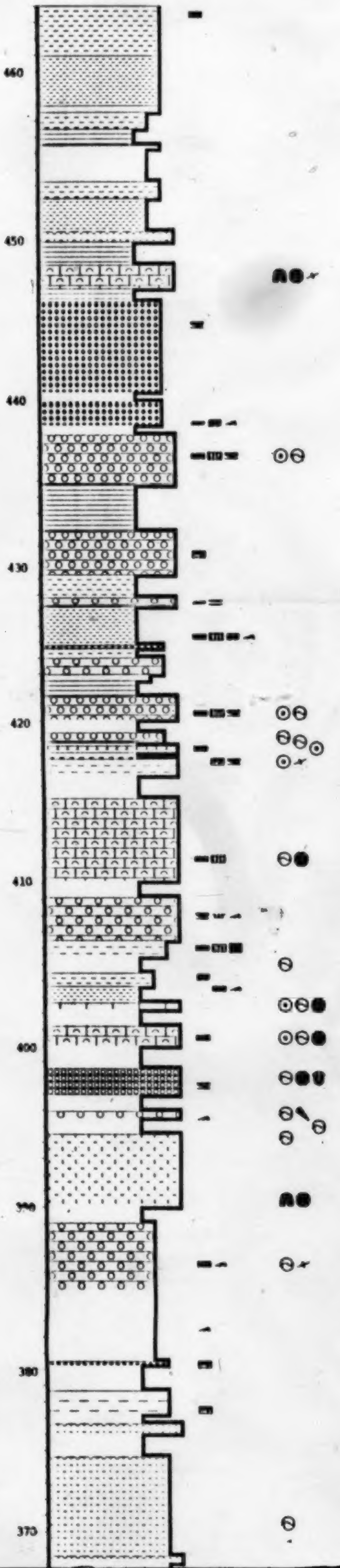
1983 GRISE FIORD 1, APPROX 10 MILES N.W. OF HEAD OF GRISE FIORD

1983 GRISE FIORD 2, APPROX 20 MILES N.W. OF HEAD OF GRISE FIORD

77 02 30 N 84 18 00 W

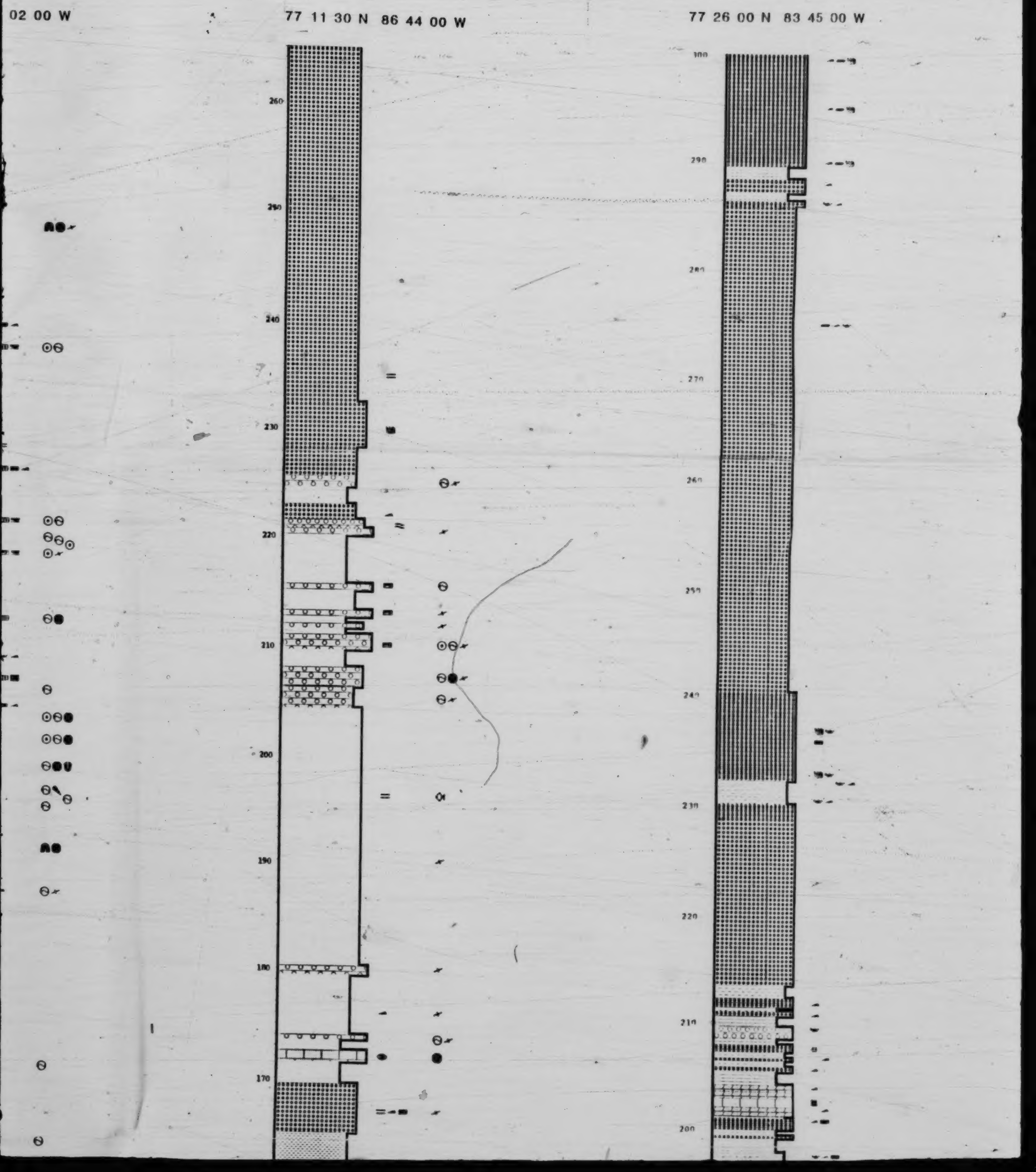
81E, BIRD FIORD, ELLESMERE ISLAND

77 12 30 N 87 02 00 W

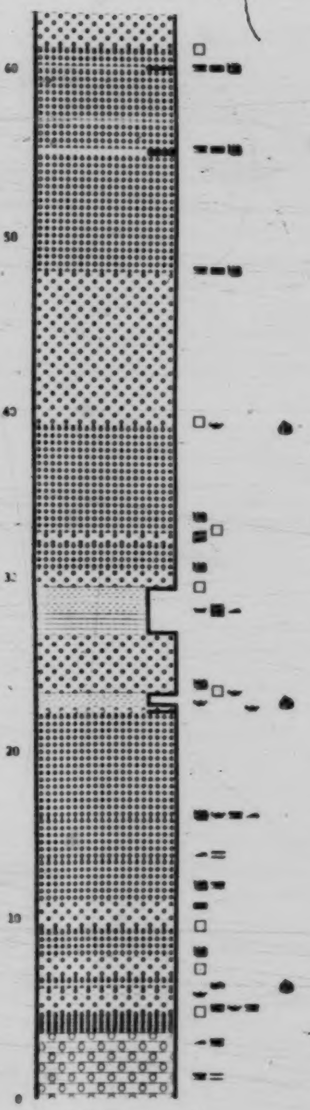


460
450
440
430
420
410
400
390
380
370

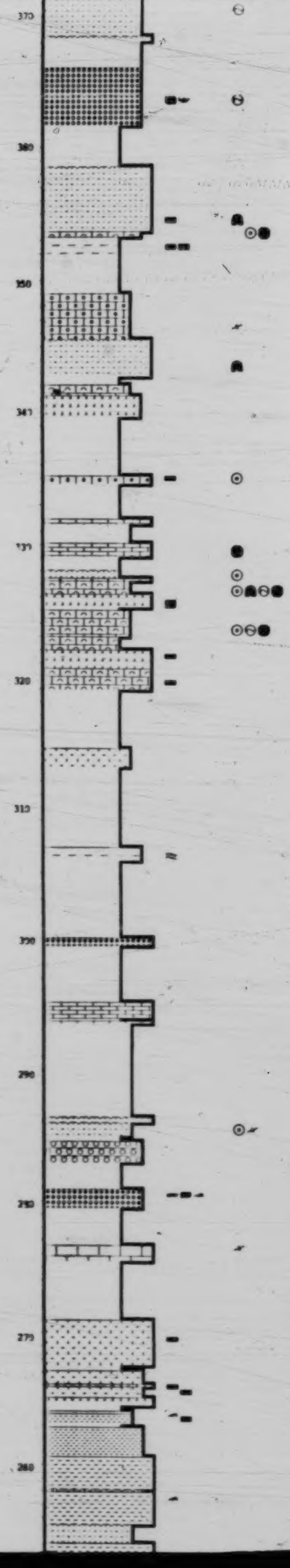
20F


02 00 W
77 11 30 N 86 44 00 W
77 26 00 N 83 45 00 W

30F

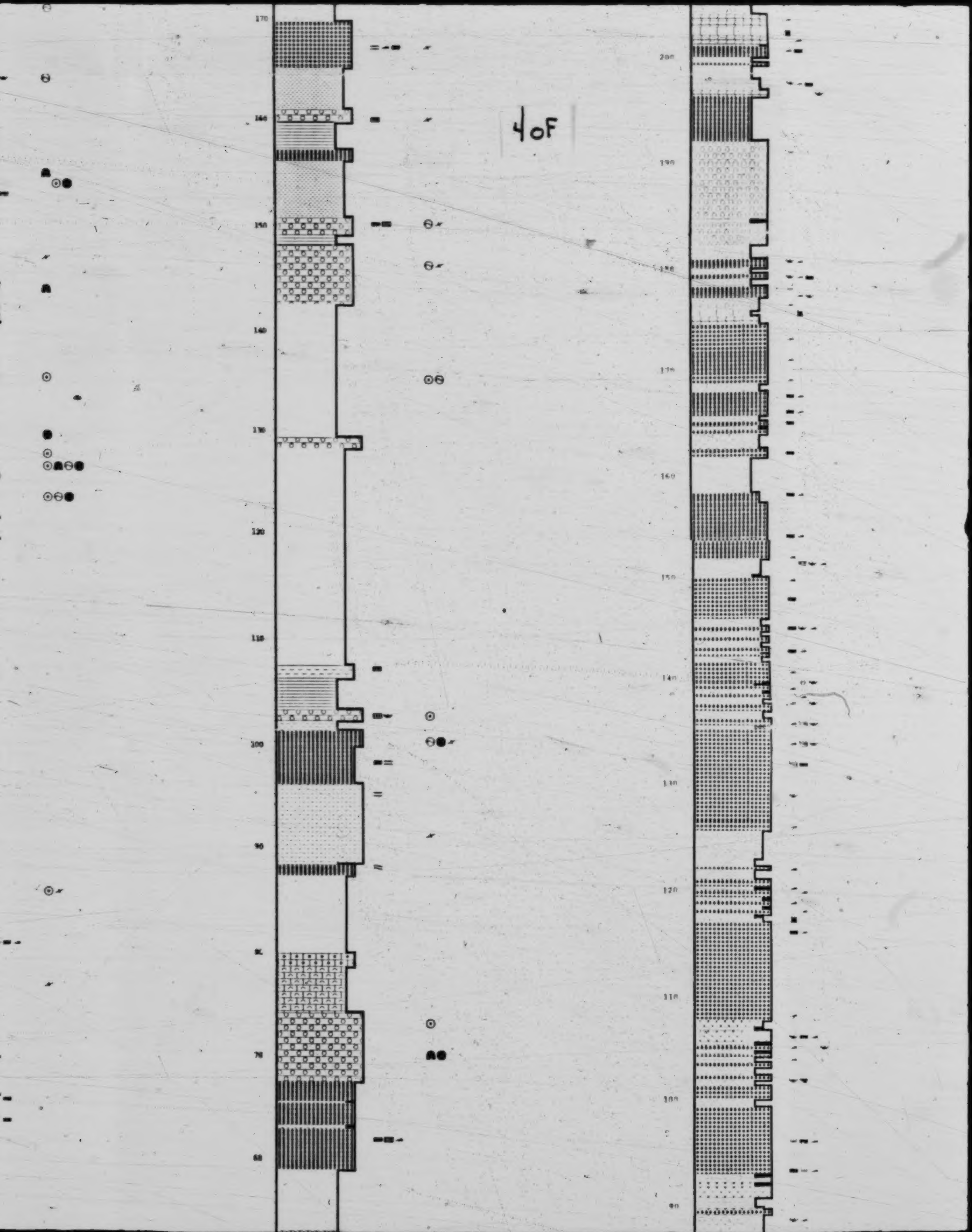

60
50
40
30
20
10
0

1983 GRISE FIORD 2, APPROX 20 MILES N.E. OF HEAD OF GRISE FIORD


370
360
350
340
330
320
310
300
290
280
270
260

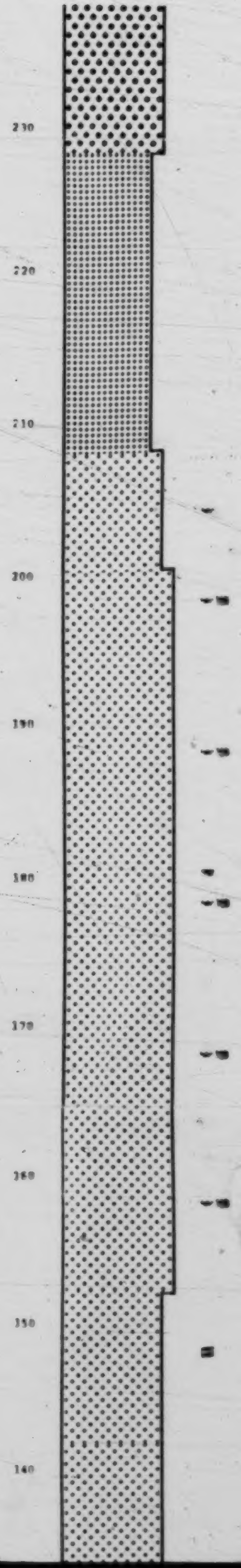
1983 BIRD FIORD TYPE SECTION. CHRIS VIAU.

4 OF

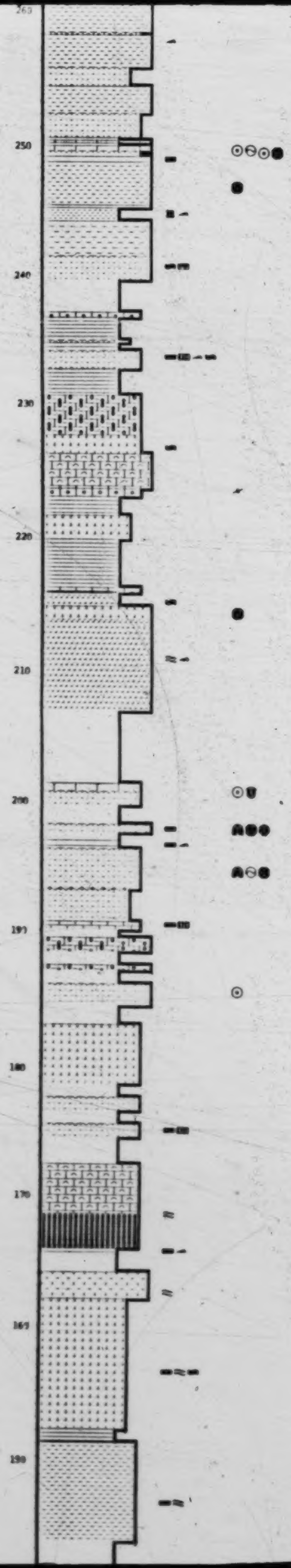


8'OF

77 12 00 N 86 15 00 W

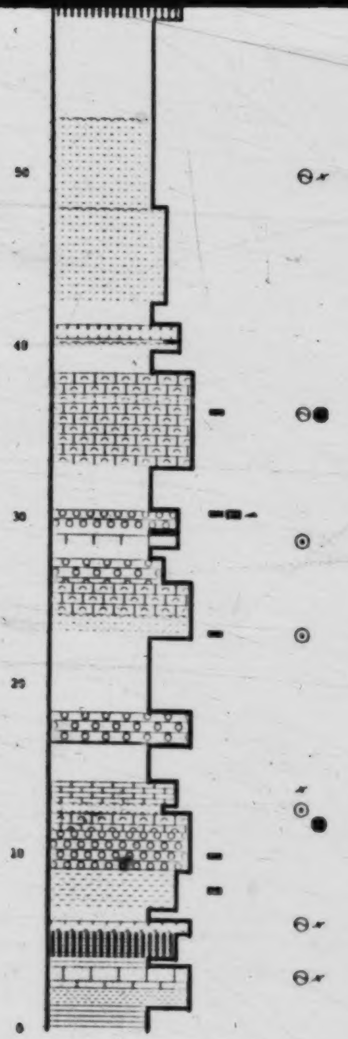


230
220
210
200
190
180
170
160
150
140



260
250
240
230
220
210
200
190
180
170
160
150

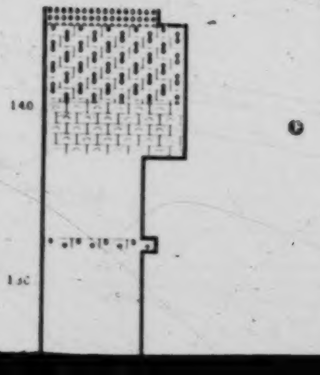
6 oF


50
40
30
20
10
0

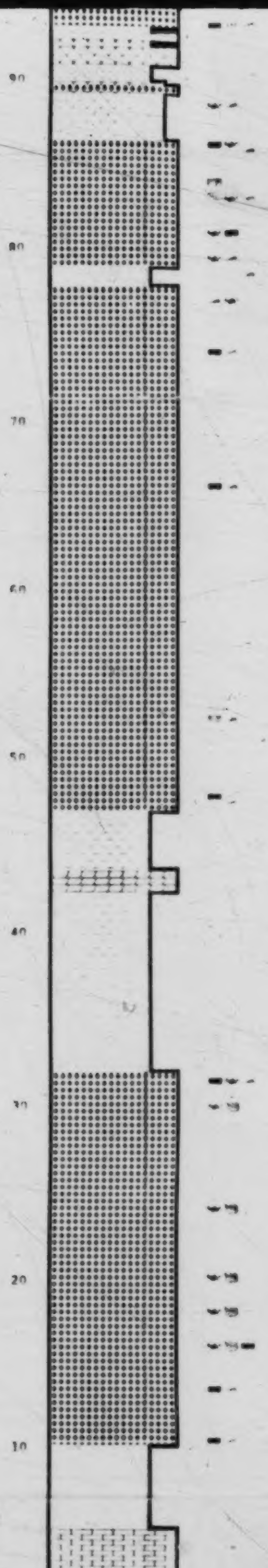
84F, BIRD FIORD, ELLESMERE ISLAND

1979 SOR FIORD, S.V. SOR FIORD. B. JONES AND Q.H. GOODBODY

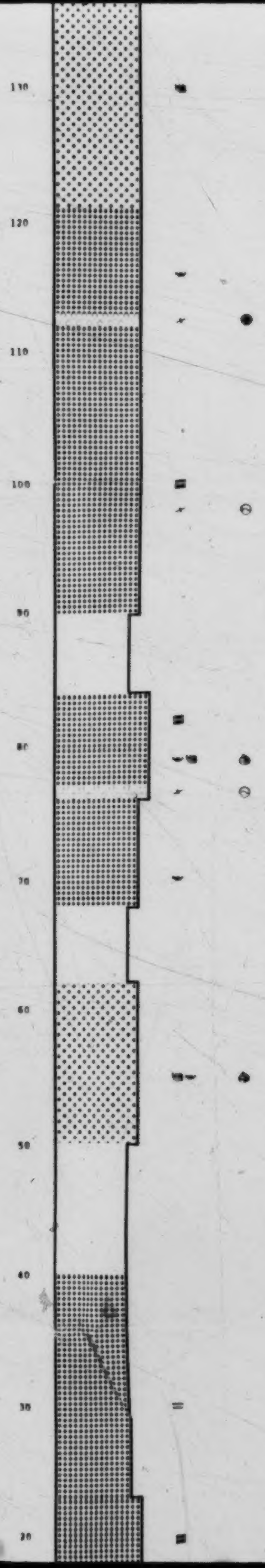
77 16 40 N 85 00 00 W

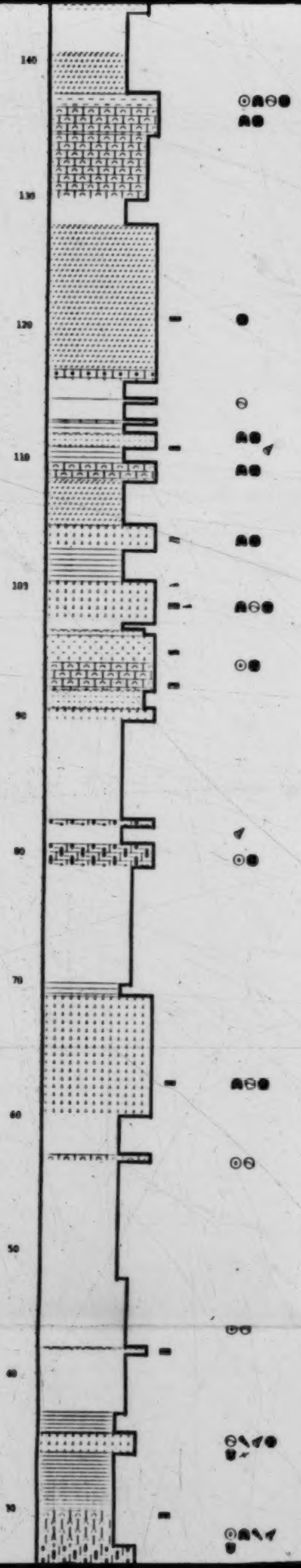


1981 STENKUL FIORD. RANDY RICE 1981

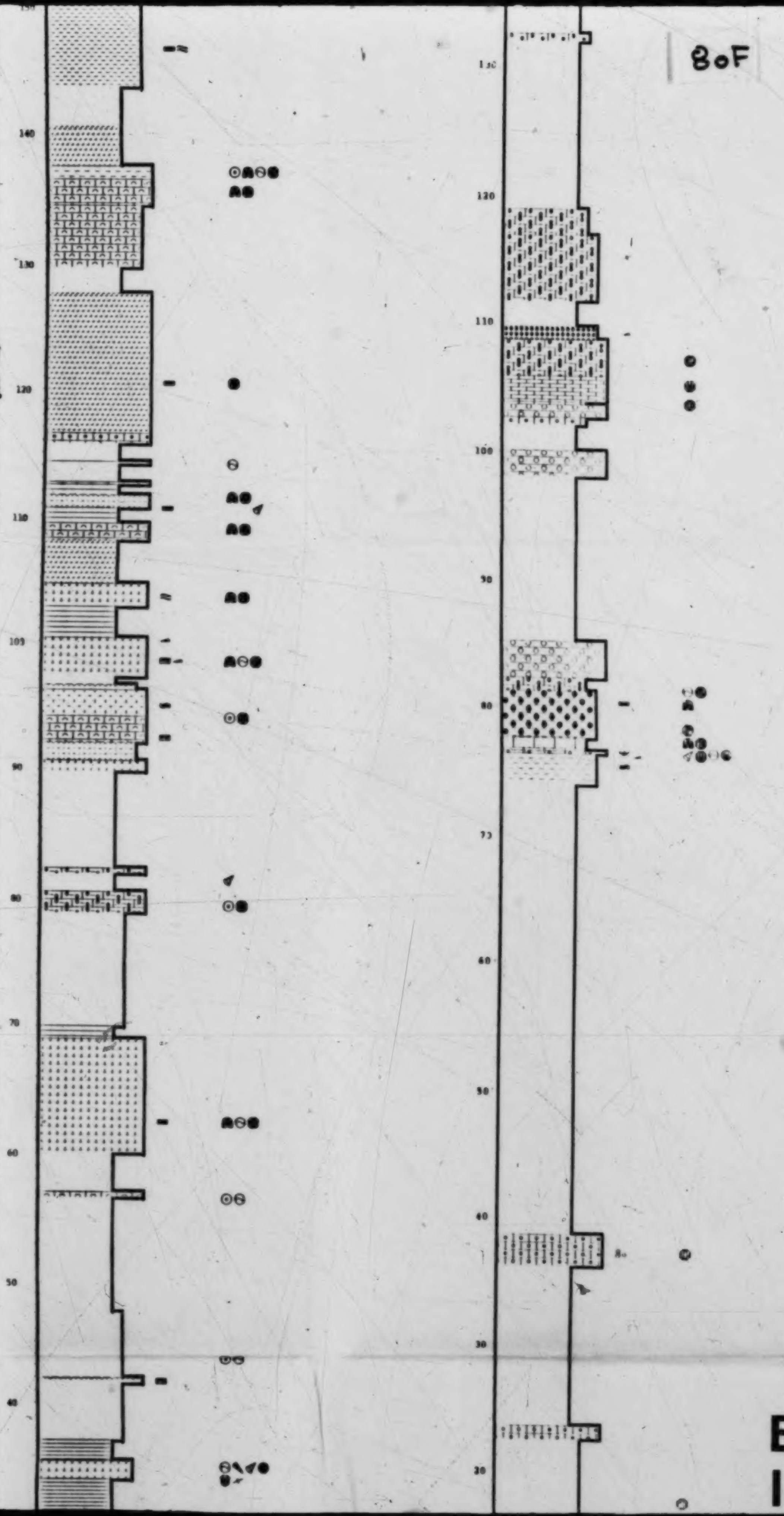

90
80
70
60
50
40
30
20
10
0

7oF



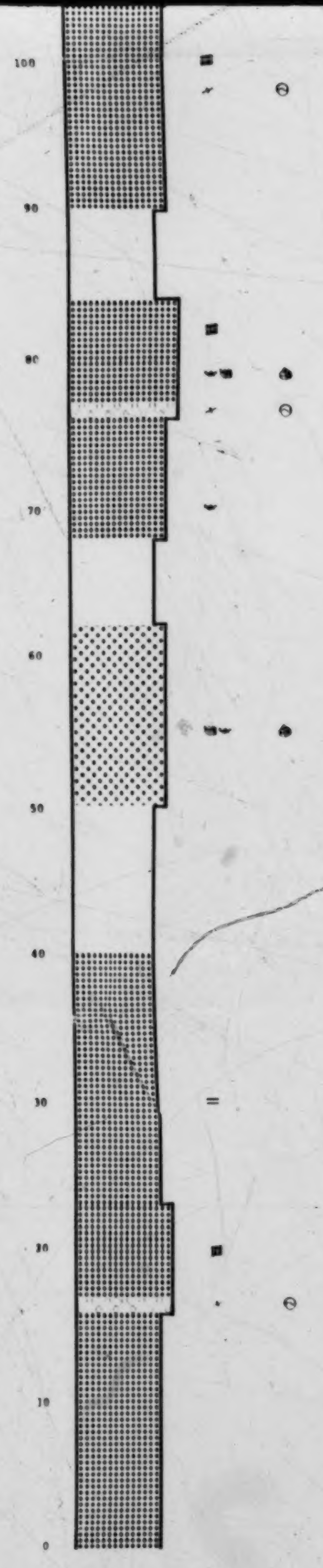


80F

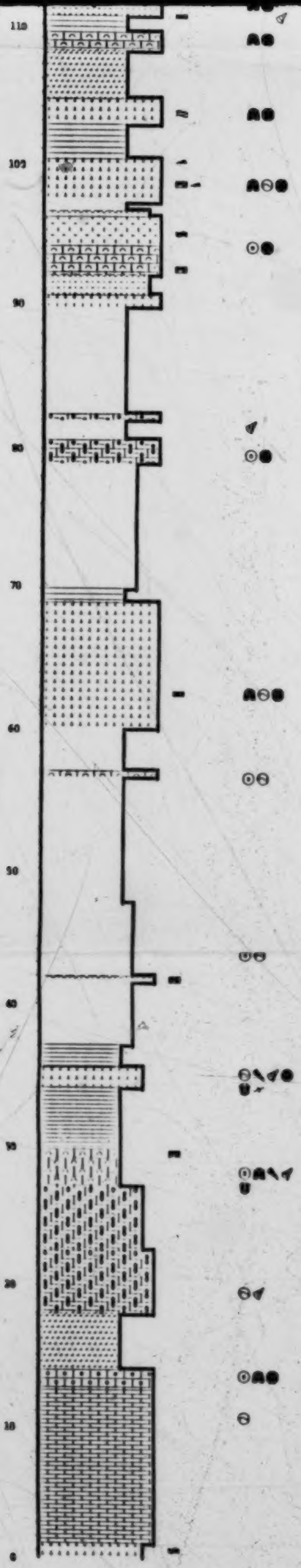


ELLESMERE ISLAND

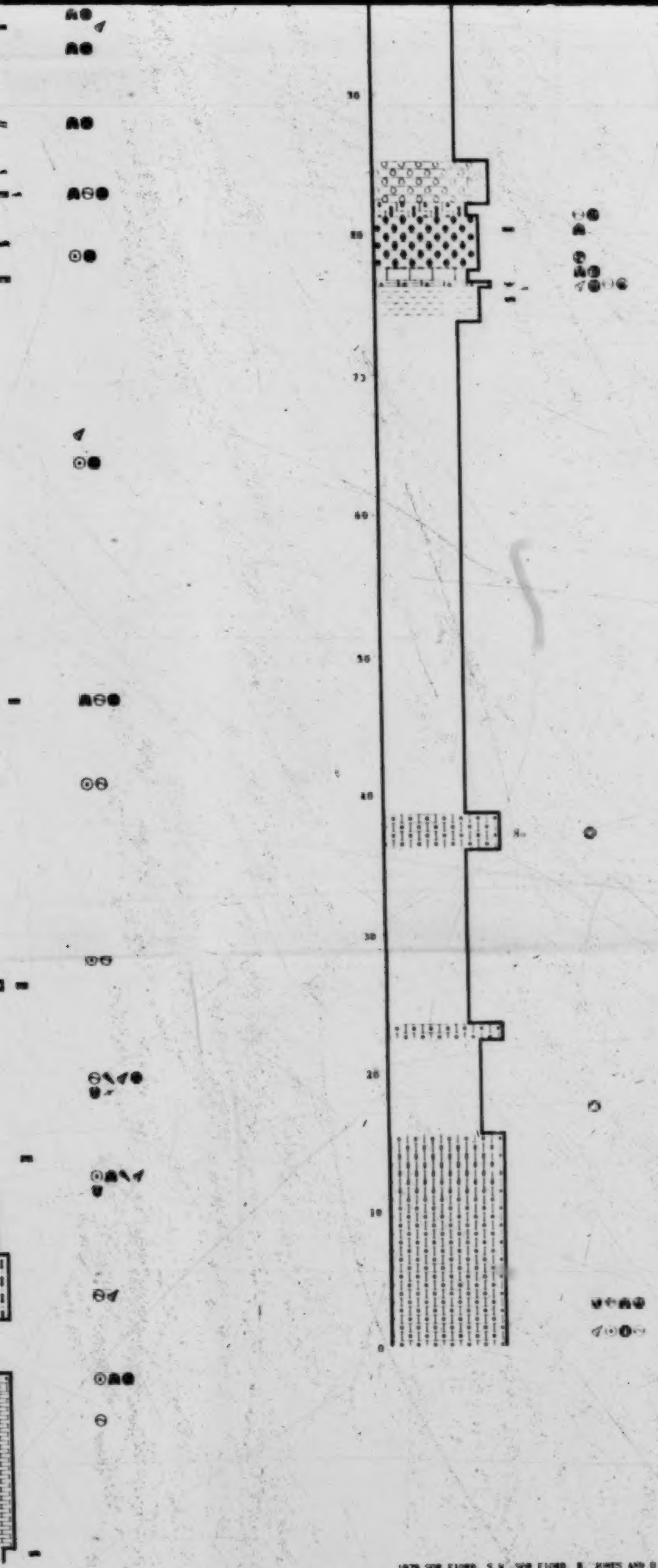
90F



100
90
80
70
60
50
40
30
20
10
0



110
100
90
80
70
60
50
40
30
20
10
0



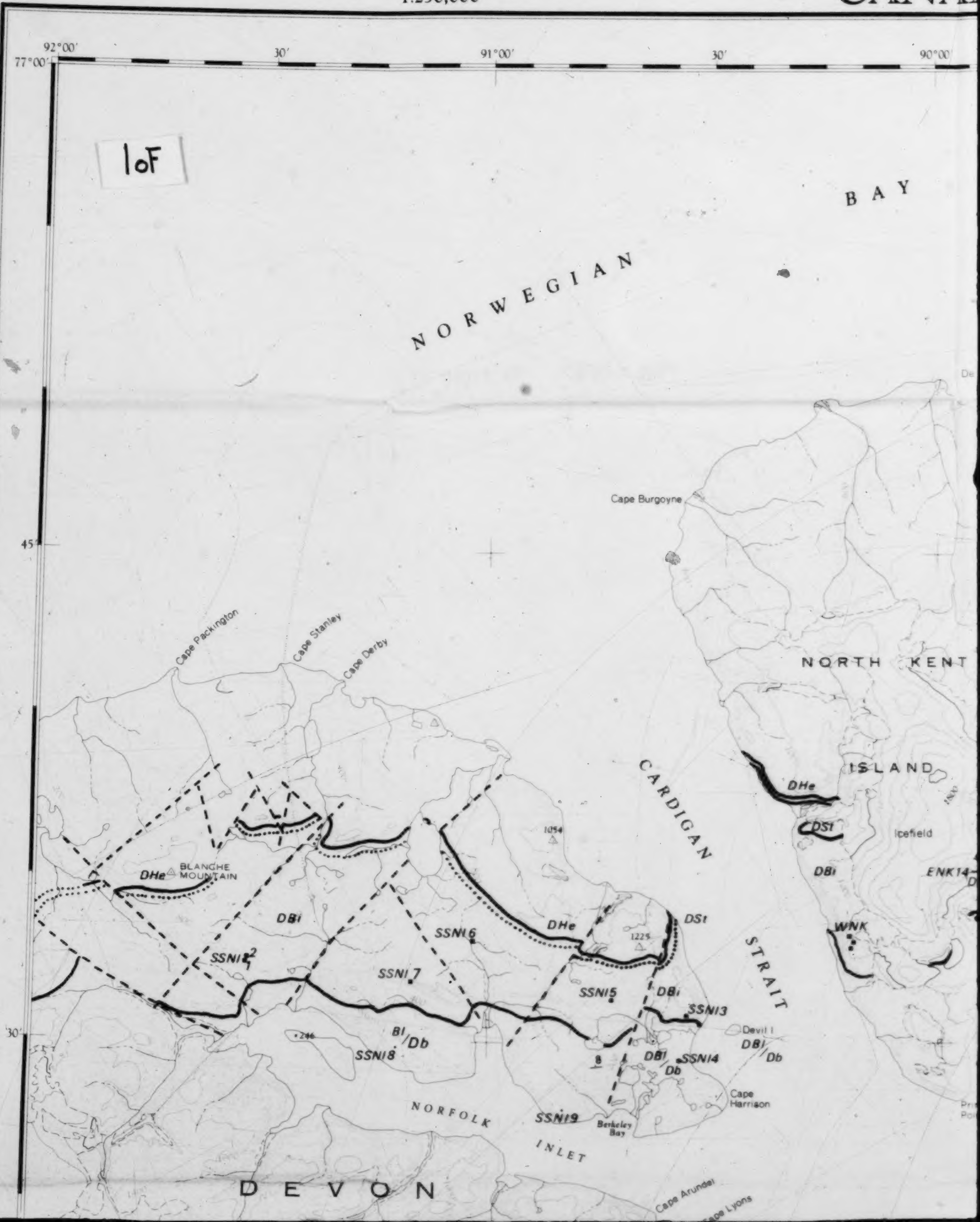
90
80
70
60
50
40
30
20
10
0
8

100F0

ELLESMERE ISLAND

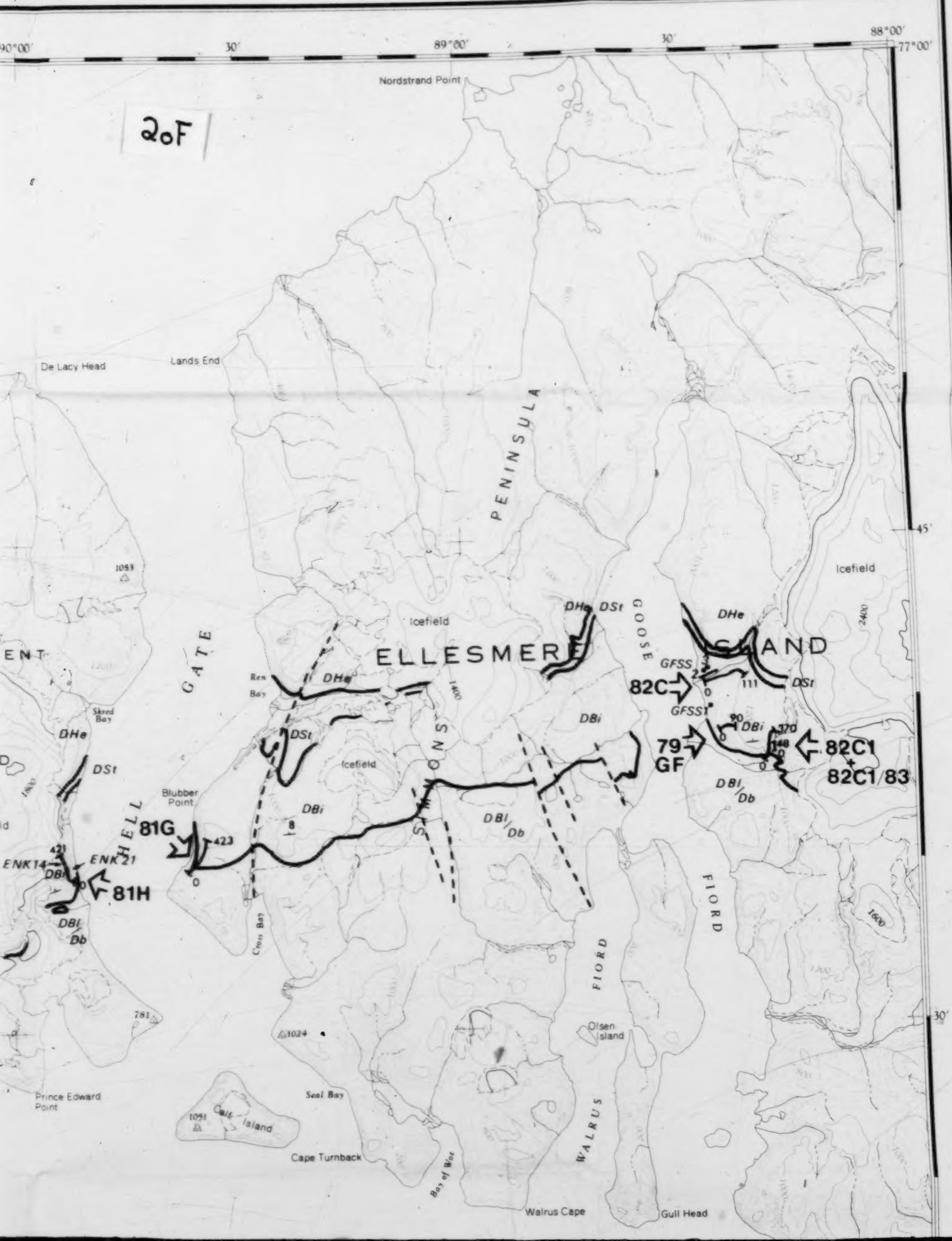
1079 SOR FIORD, S.W. SOR FIORD. B. JONES AND G.B. [illegible]

59A 1:250,000 CANA

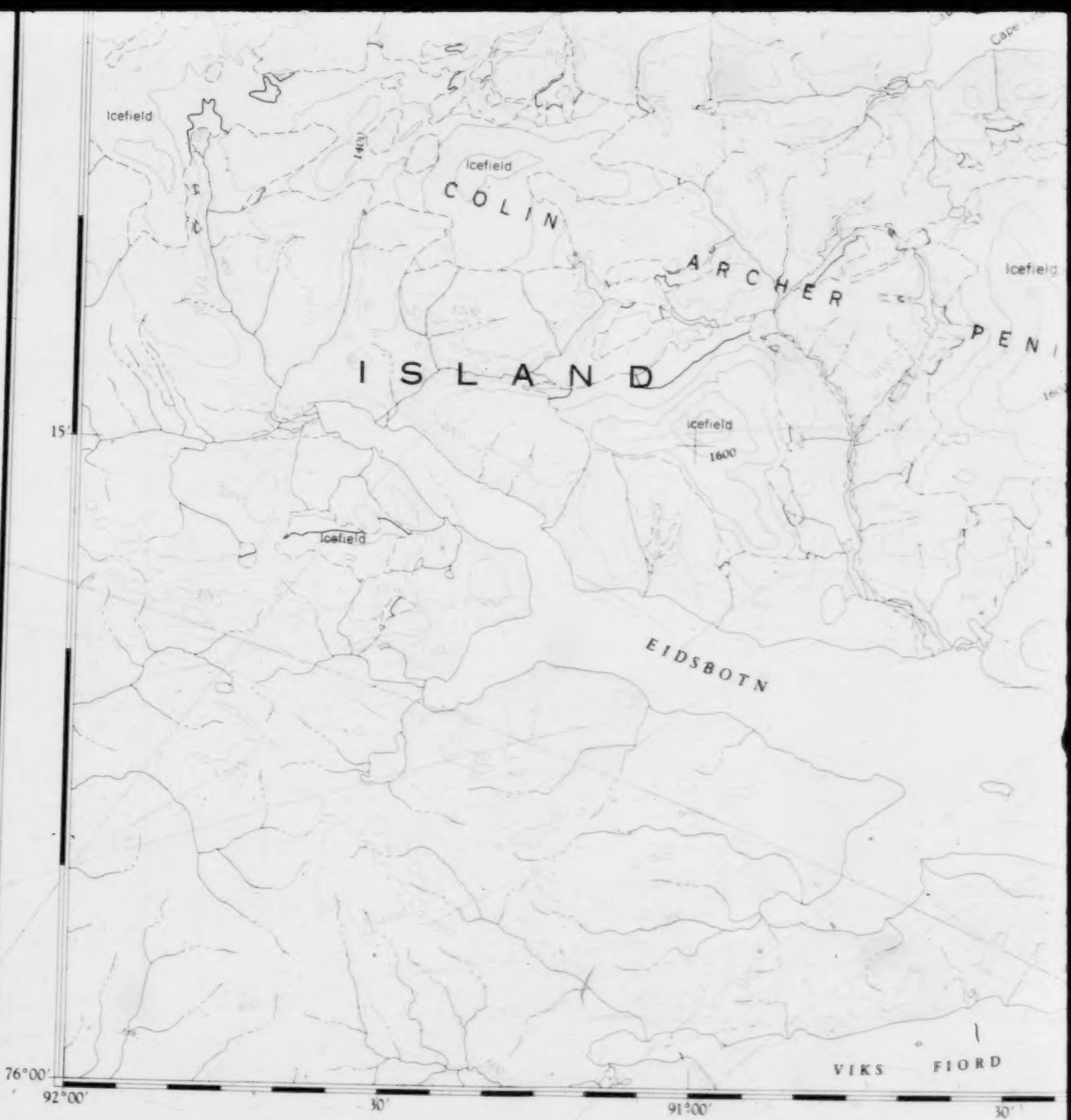

92°00′
30′
91°00′
30′
90°00′
77°00′
45′
30′
1oF
NORWEGIAN BAY
Cape Burgoyne
NORTH KENT ISLAND
Icefield
ENK14
Cape Packington
Cape Stanley
Cape Derby
CARDIGAN STRAIT
BLANCHE MOUNTAIN
DHe
DBi
DSt
WNK
1054
1225
SSN12
SSN16
SSN17
SSN15
SSN13
SSN14
SSN18
SSN19
Bl/Db
DBl/Db
246
8
Devil I
Cape Harrison
Berkeley Bay
NORFOLK INLET
DEVON
Cape Arundel
Cape Lyons

NADA

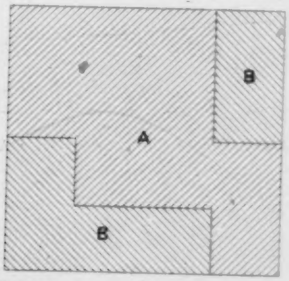
EDITION 1


90°00′
30′
89°00′
30′
88°00′
77°00′
45′
30′
20F
Nordstrand Point
De Lacy Head
Lands End
PENINSULA
Icefield
ELLESMERE
ISLAND
GOOSE
FIORD
GATE
HELL
ENT
SIMMONS
Ren Bay
Skred Bay
Blubber Point
Cross Bay
Seal Bay
Cape Turnback
Bay of Woe
Walrus Cape
Gull Head
WALRUS
FIORD
Olsen Island
Cairn Island
Prince Edward Point
1093
1024
1091
781
1400
1600
2400
DHe
DSt
DBi
DBl/Db
GFSS
GFSS1
82C
82C1
82C1/83
79 GF
81G
81H
ENK14
ENK21
423
421
111
90
370
148
8
2
0

30F


Icefield
Icefield
COLIN
ARCHER
PENI
Icefield
ISLAND
Icefield
1600
Icefield
EIDSBOTN
VIKS
FIORD
1400
15'
76°00'
92°00'
30'
91°00'
30'
Cape

RELIABILITY DIAGRAM - CROQUIS D'EXACTITUDE



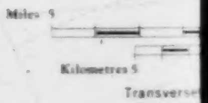
A - Large scale topographic maps, photogrammetric, 1963-64.
B - Large scale topographic manuscripts, photogrammetric, 1964.

A - Cartes topographiques à grande échelle, photogrammétrie 1963-64.
B - Manuscrits topographiques à grande échelle, photogrammétrie 1964.

Compiled, 1964, by the SURVEYS AND MAPPING BRANCH, DEPARTMENT OF MINES AND TECHNICAL SURVEYS, from aerial photographs taken in 1958-59. Field surveys 1961. Printed 1965.

The daily change of the North Magnetic Pole renders the magnetic compass unreliable in this area. The 1964 magnetic declination for this map varies from 96°00' westerly at centre of west edge to 90°20' westerly at centre of east edge.

Road, dry weather	Route, temps sec	═
Wagon or winter road	Chemin de terre ou d'hiver	— — —
Trail or portage	Sentier ou portage	- - - -
Town	Ville	□
Village or Settlement	Village ou hameau	○
Post Office	Bureau de poste	P
Horizontal control point	Point géodésique	△
Boundary monument	Borne frontière	◻

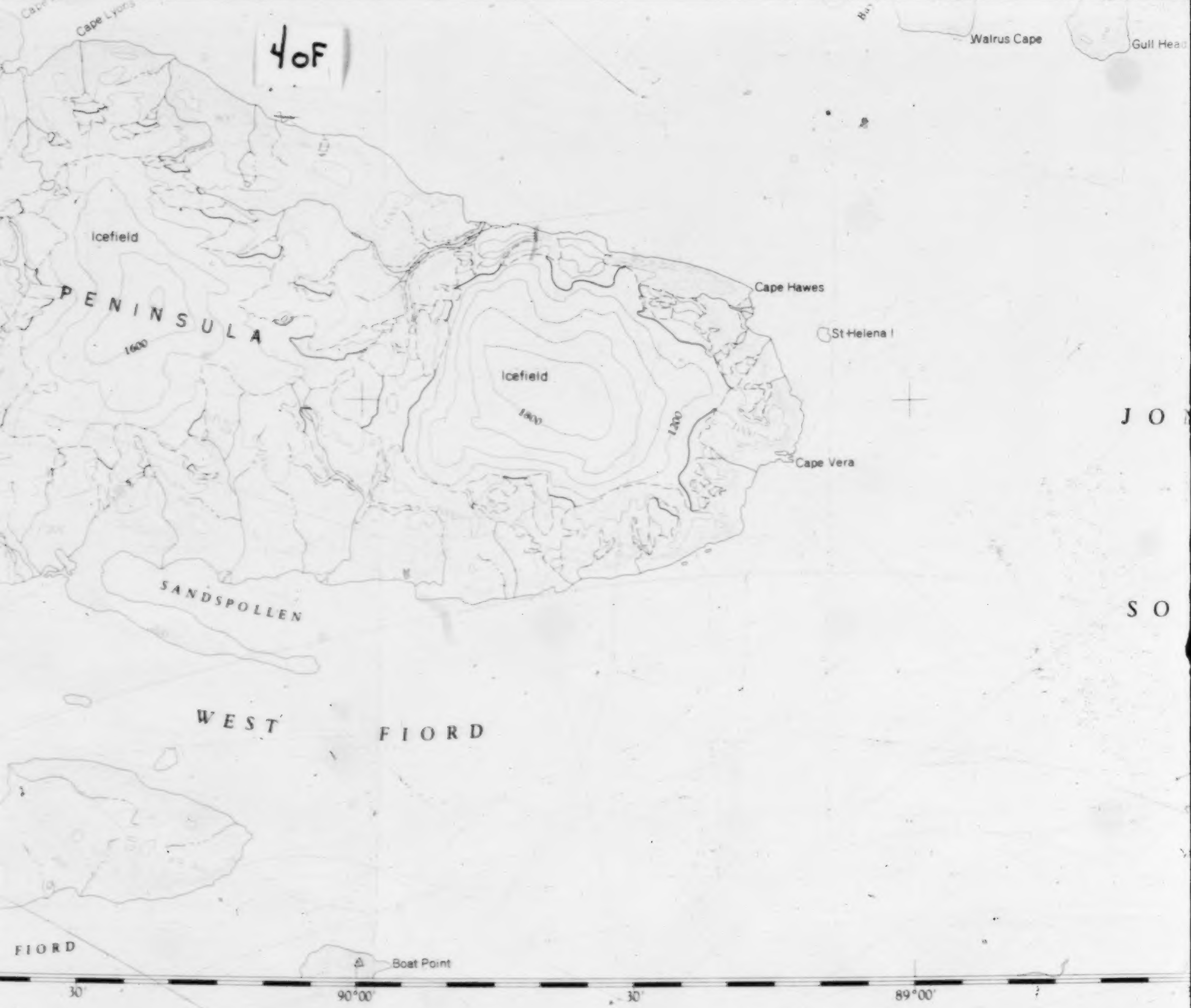

Miles 5
Kilometres 5

Transverse
North Am
Contour
Elevations in fe

Copies may be obta
Department of Ener
or your nearest map

© Canada Copyri

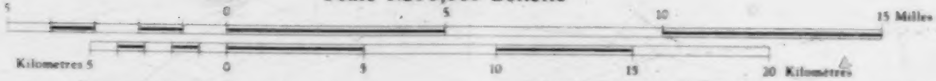
4oF


Cape Lyons
Walrus Cape
Gull Hea
Icefield
PENINSULA
1600
Icefield
1800
1200
Cape Hawes
St Helena I
JO
Cape Vera
SO
SANDSPOLLEN
WEST FIORD
FIORD
Boat Point
30'
90°00'
30'
89°00'

CARDIGAN STRAIT

DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES

Scale 1:250,000 Échelle


Miles 5
0
5
10
15 Milles
Kilometres 5
0
5
10
15
20 Kilomètres

Transverse Mercator Projection
North American Datum 1927
Contour Interval 200 feet
Elevations in feet above Mean Sea Level

Projection Transverse de Mercator
Niveau de référence nord-américain, 1927
Équidistance des courbes: 200 pieds
Élévations en pieds au-dessus du niveau moyen de la mer

Copies may be obtained from the Canada Map Office
Department of Energy, Mines and Resources, Ottawa
or your nearest map dealer

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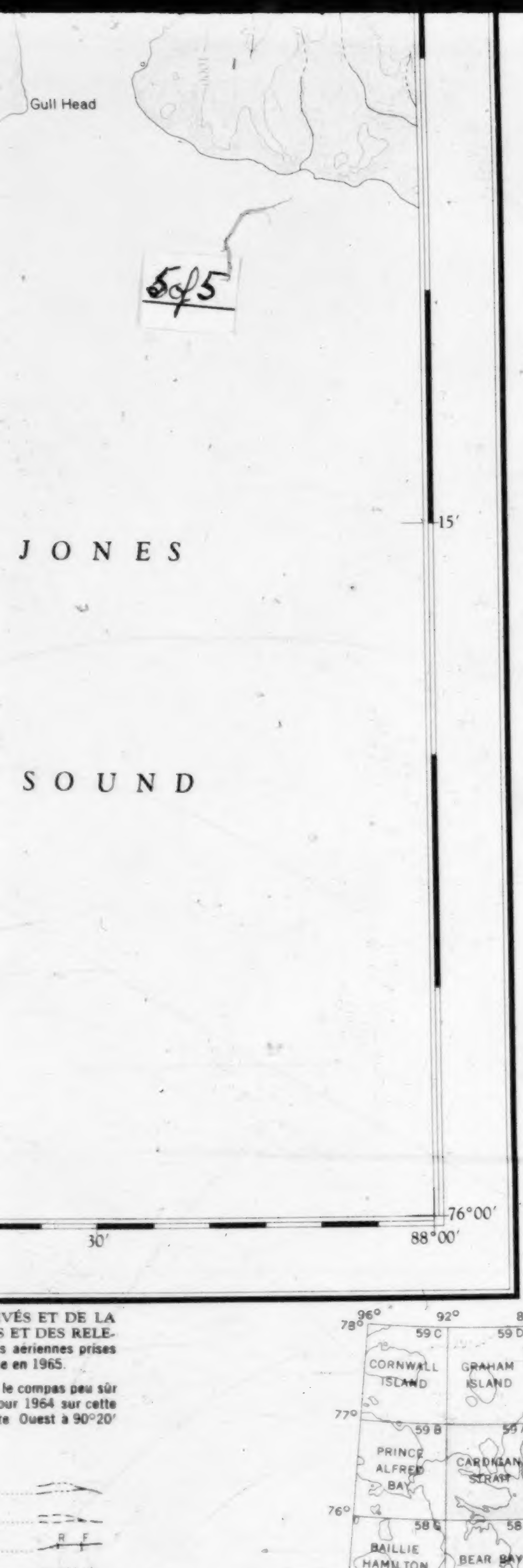
ministère de l'Énergie, des Mines et des Ressources, Ottawa
au chez le vendeur le plus près

© Canada 1974, tous droits réservés

Rédigée en 1964, par la DIRECTION DES LEVÉS ET DE CARTOGRAPHIE, MINISTÈRE DES MINES ET DES RE VÉS TECHNIQUES, d'après des photographies aériennes pr en 1958-59. Levés sur le terrain en 1961. Imprimée en 1965.

La variation diurne du pôle Nord magnétique rend le compas pe dans cette région. La déclinaison magnétique pour 1964 sur carte varie de 96°00' Ouest au centre de la limite Ouest à 90 Ouest au centre de la limite Est.

Stream	Cours d'eau	
intermittent or dry	intermittent ou à sec	
indefinite	imprécis	
Rapids; falls	Rapides; chute	R
Marsh or swamp	Marais ou marécage	
Intermittent lake	Lac intermittent	
Depression contours	Courbes de cuvette	
Spot Elevation, in feet	Repère de nivellement en pieds	25

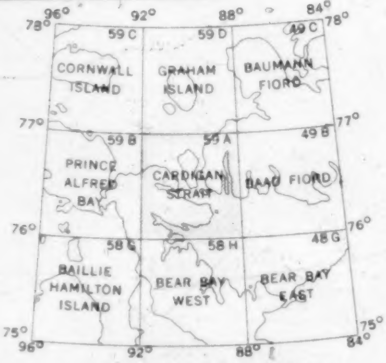

Gull Head
JONES
SOUND
15′
76°00′
30′
88°00′

5of5

VÉS ET DE LA
S ET DES RELE-
s aériennes prises
e en 1965.

le compas peu sûr
our 1964 sur cette
te Ouest à 90°20′

n pieds.....2550.


96°
92°
88°
84°
78°
59 C
59 D
49 C
CORNWALL ISLAND
GRAHAM ISLAND
BAUMANN FIORD
77°
59 B
59 A
49 B
PRINCE ALFRED BAY
CARDIGAN STRAIT
BAAD FIORD
76°
58 G
58 H
48 G
BAILLIE HAMILTON ISLAND
BEAR BAY WEST
BEAR BAY EAST
75°

Index to adjoining sheets of National Topographic System

Tableau d'assemblage du Système National de Référence Cartographique

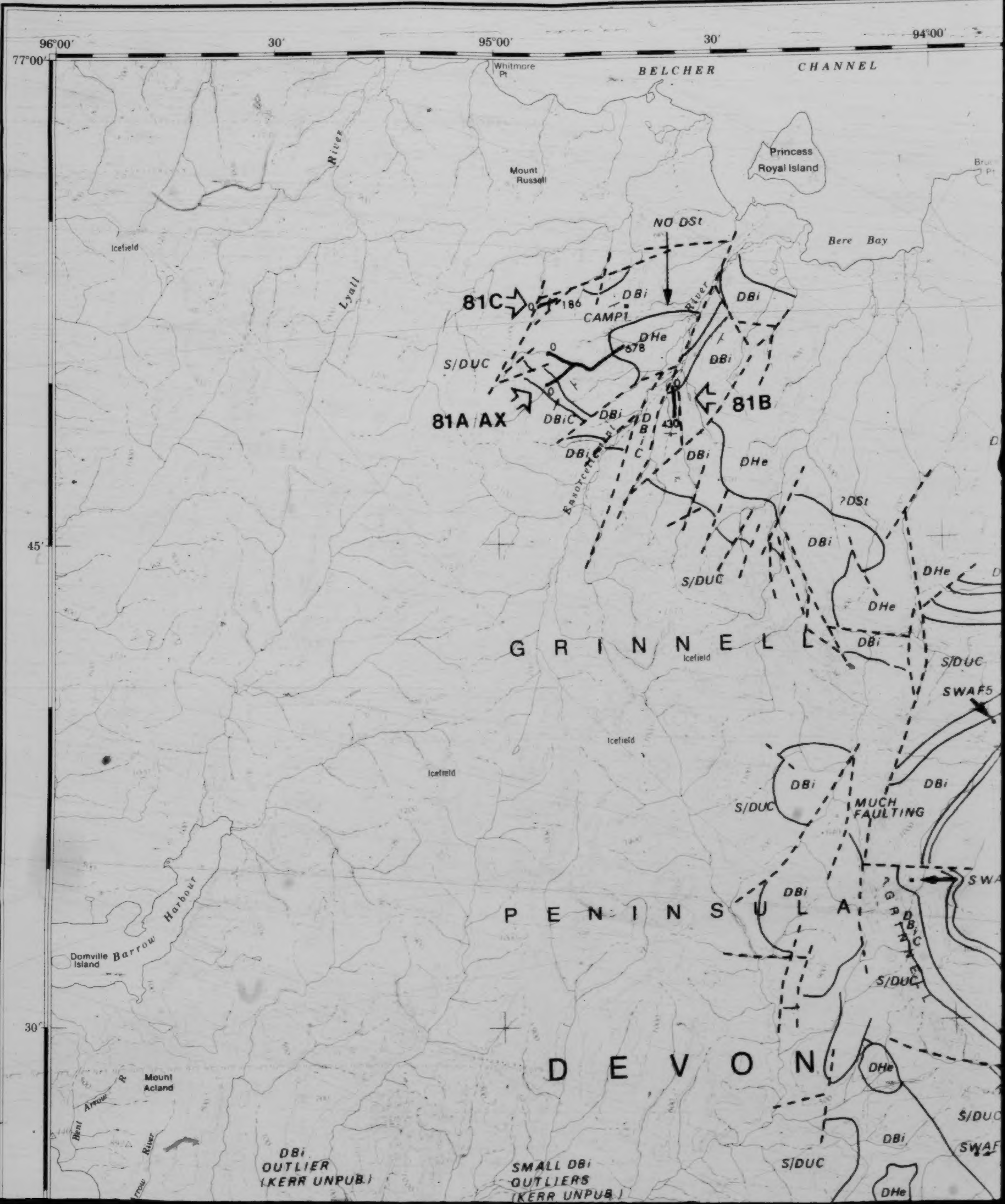
LEGEND

DHe	Hecla Bay Fm
DSt	Strathcona Fiord Fm
DBi	Bird Fiord Fm
DBl/Db	Blue Fiord/Disappointment Bay Fm undifferentiated
⇨	measured section (meters)
·SS	spot locality
....	covered contact
-----	fault

CARDIGAN STRAIT
59 A
EDITION 1

1oF

59B EDITION 2 Canada

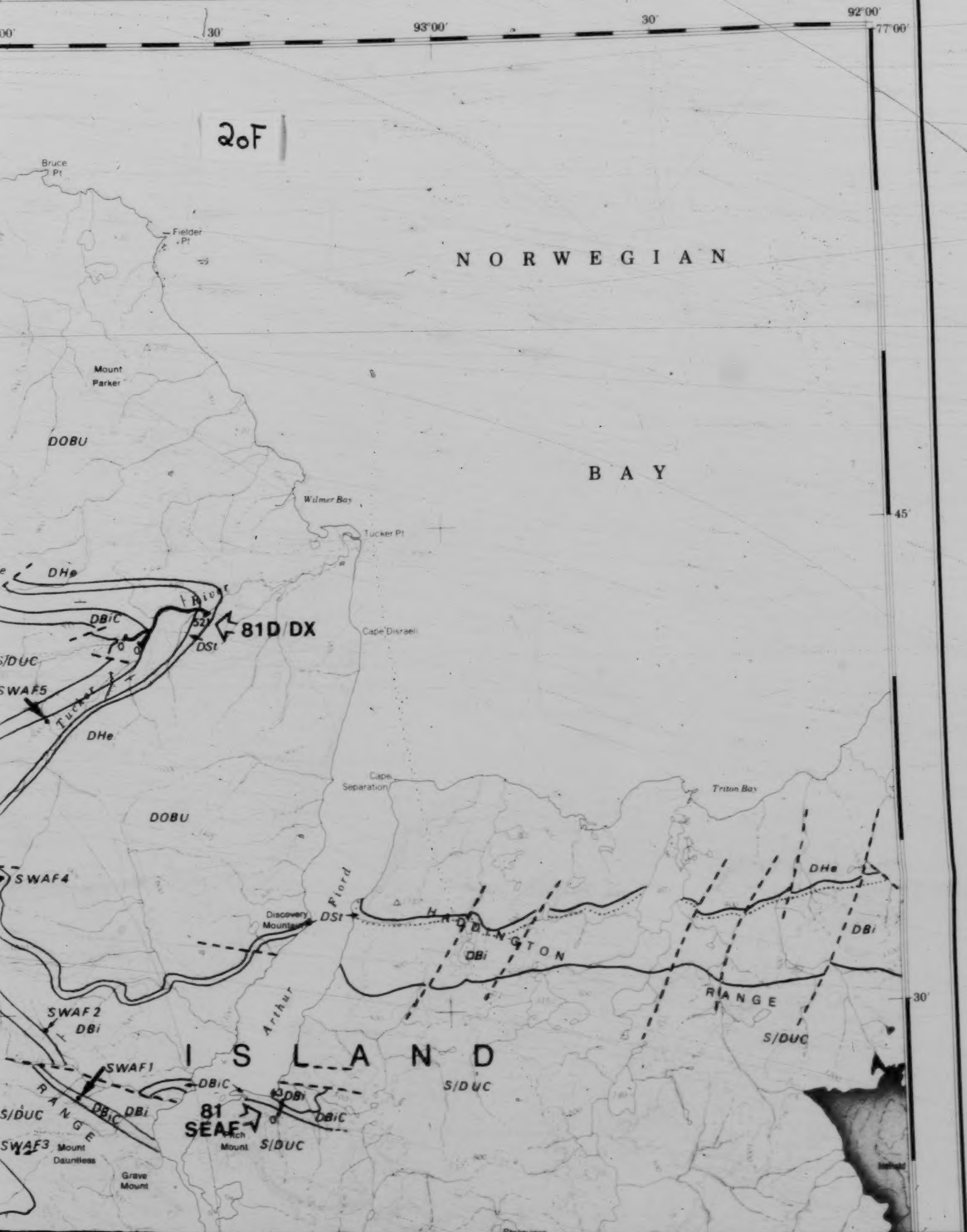


96°00′
30′
95°00′
30′
94°00′
77°00′
45′
30′
Whitmore Pt
BELCHER CHANNEL
Princess Royal Island
Mount Russell
Bere Bay
River
Lyall
Icefield
NO DSt
81C
186
DBi
CAMP1
River
DBi
DHe
678
S/DUC
0
0
DBi
81A/AX
0
DBiC
DBi
D B C
430
81B
DBiC
DBi
DHe
Eureka
?DSt
DBi
DHe
S/DUC
DHe
DBi
G R I N N E L L
Icefield
S/DUC
SWAF5
Icefield
Icefield
DBi
DBi
S/DUC
MUCH FAULTING
SWA
DBi
P E N I N S U L A
?GRINNELL
DBiC
S/DUC
Domville Island
Barrow Harbour
D E V O N
DHe
Mount Acland
Arrow R
Bent
River
S/DUC
DBi
SWAF
DBi OUTLIER (KERR UNPUB.)
SMALL DBi OUTLIERS (KERR UNPUB.)
S/DUC
DHe

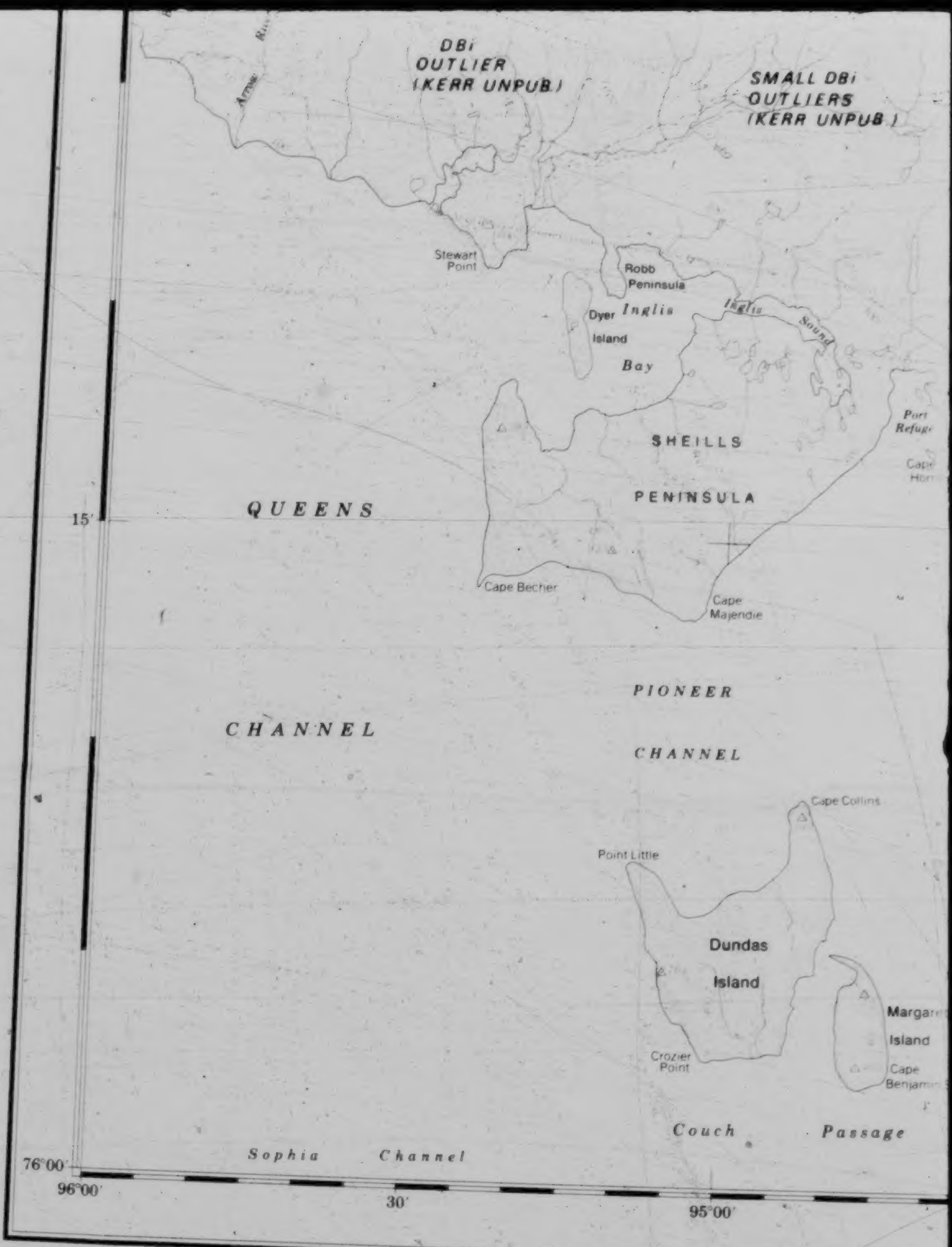
EDITION 2

59B

20F


00'
30'
93°00'
30'
92°00'
77°00'
45'
30'
NORWEGIAN
BAY
Bruce Pt
Fielder Pt
Mount Parker
DOBU
Wilmer Bay
Tucker Pt
DHe
River
DBiC
81D DX
DSt
S/DUC
SWAF5
Tucker
Cape Disraeli
Cape Separation
Triton Bay
DOBU
SWAF4
Fiord
Discovery Mountain
DSt
HOUGHTON
DBi
RANGE
Arthur
SWAF 2
DBi
ISLAND
SWAF1
DBiC
DBi
81
SEAF
S/DUC
RANGE
DBiC
SWAF3
Mount Dauntless
Grave Mount
Pitch Mount
S/DUC
DBi
DHe
S/DUC

30F


DBi
OUTLIER
(KERR UNPUB.)
SMALL DBi
OUTLIERS
(KERR UNPUB.)
Stewart Point
Robb Peninsula
Dyer Island
Inglis Bay
Inglis Sound
SHEILLS PENINSULA
Port Refuge
Cape Horn
QUEENS CHANNEL
Cape Becher
Cape Majendie
PIONEER CHANNEL
Cape Collins
Point Little
Dundas Island
Crozier Point
Margaret Island
Cape Benjamin
Couch Passage
Sophia Channel
15′
76°00′
96°00′
30′
95°00′

1962

Produced by the SURVEYS AND MAPPING BRANCH,
DEPARTMENT OF ENERGY, MINES AND RESOURCES.
Information current as shown in diagram. Published in 1984.

Copies may be obtained from the Canada Map Office,
Department of Energy, Mines and Resources, Ottawa,
or your nearest map dealer.

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Department of Energy, Mines and Resources.

This map was checked in 1980 and found to be up to-date in all major features.

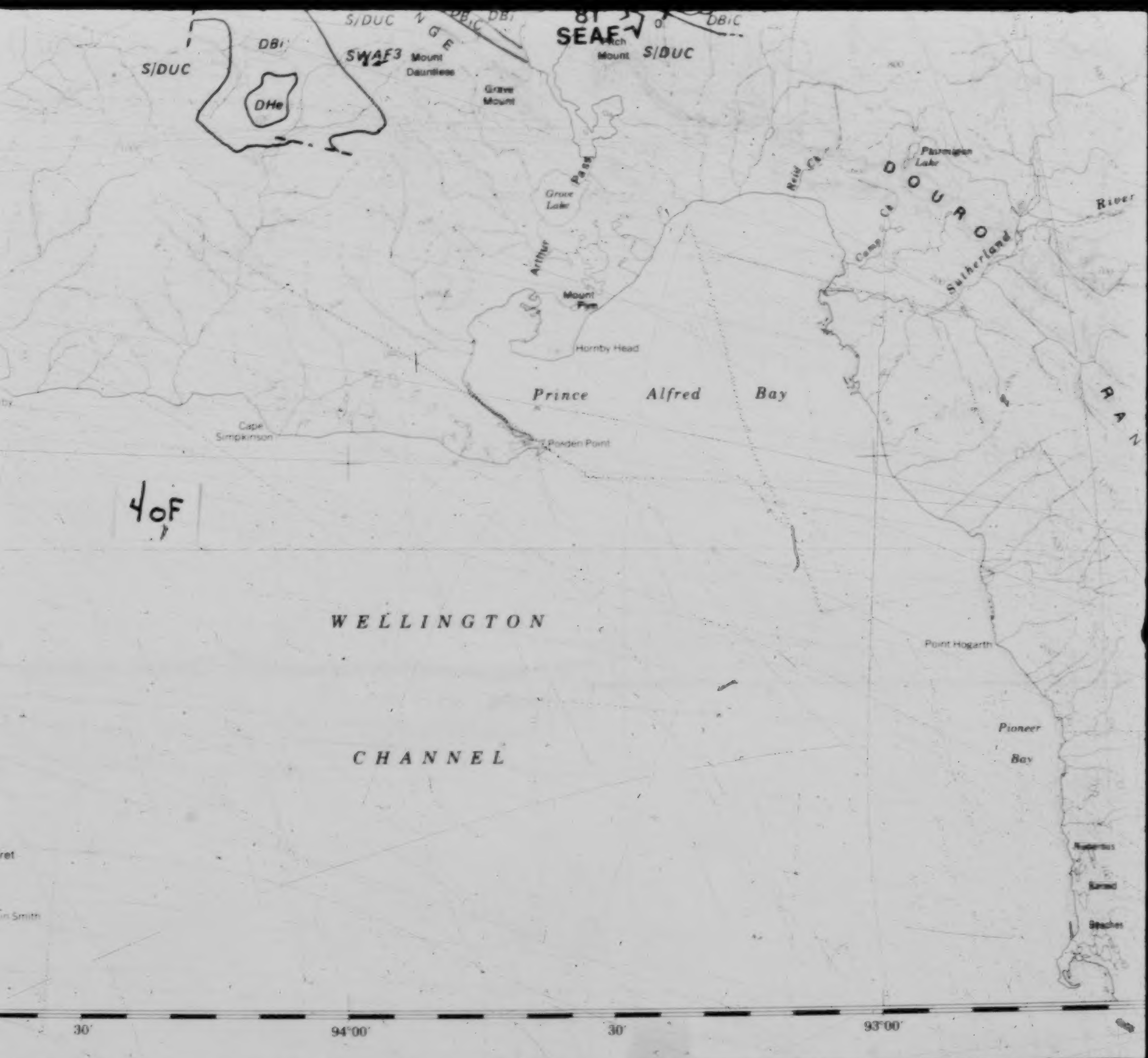
N

Roads	Routes
cart track	de terre
trail, cut line or portage	sentier, percée ou portage

FOR COMPLETE REFERENCE SEE REVERSE SIDE   POUR UNE LISTE COMPLETE DES SIGNES, VOIR AU VERSO

Miles 5

Kilometres 5


S/DUC
DBi
DBiC
81
SEAF
S/DUC
DBi
DHe
SWAF3
Mount Dauntless
Grave Mount
Arch Mount
S/DUC
Grace Lake
Pass
Arthur
Mount Pim
Hornby Head
Reid Cr.
Ptarmigan Lake
D O U R O
Camp Cr.
Sutherland
River
R A N
Prince Alfred Bay
Cape Simpkinson
Powden Point
4oF
WELLINGTON
CHANNEL
Point Hogarth
Pioneer Bay
Robertus
Barnard
Beaches
30′
94°00′
30′
93°00′

PRINCE ALFRED BAY

DISTRICT OF FRANKLIN

NORTHWEST TERRITORIES   TERRITOIRES DU NORD-OUEST

Scale 1:250 000 Échelle

0 5 10 15 20 Milles

5 0 5 10 15 20 25 30 Kilomètres

The magnetic compass is likely to be useless in this area.

Magnetic declination 1984 varies from 82°17′ westerly at centre of west edge to 81°35′ westerly at centre of east edge. Mean annual change decreasing 1°31.5′

La boussole sera probablement inutile dans cette région.

En 1984, la déclinaison magnétique varie vers l'ouest de 82°17′ au centre du bord ouest à 81°35′ au centre du bord est. La variation annuelle moyenne décroît de 1°31.5′

Cette carte a été vérifiée en 1980 et nous avons constaté que toutes ses caractéristiques principales étaient à jour.

Établie par la DIRECTION DE
MINISTÈRE DE L'ÉNERGI
Renseignements à jour tels qu

Ces cartes sont en vent
ministère de l'Énergie
ou chez le vendeur le p

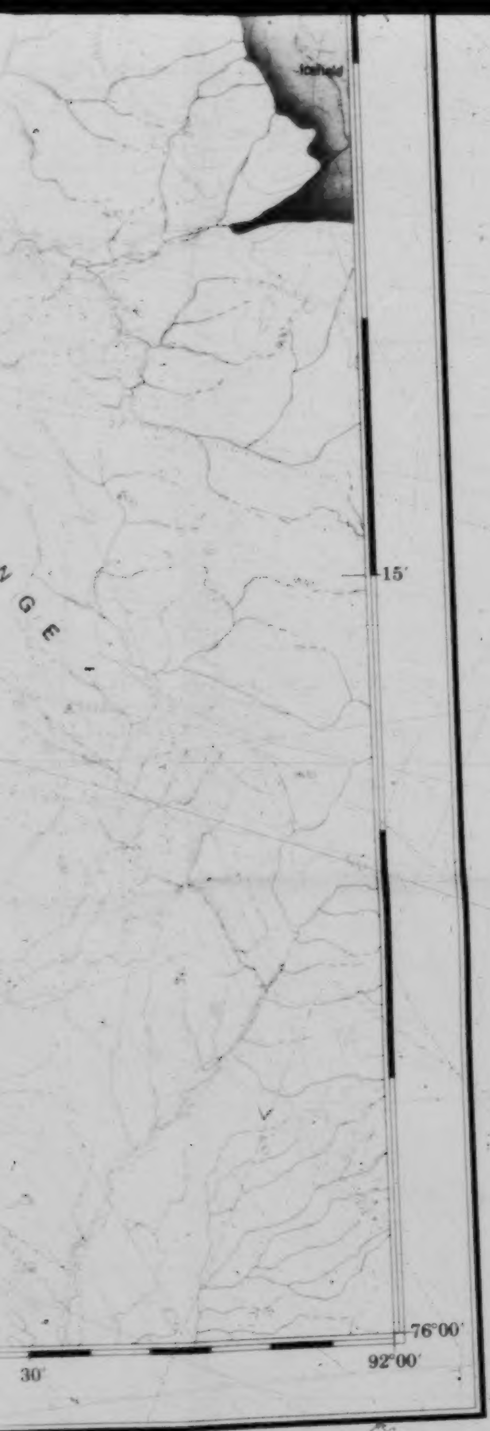
© 1984 Sa Majesté
Ministère de l'Éner

CONVERSION SCALE FOR ELEVATIONS

Metres 30 20 10 0 50 100

Feet 100 50 0 100 200 300 4

CONTOUR INTERVAL 100 FEET
Elevations in Feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection



LEGEND

DOBU	Okse Bay Group undifferentiated
DHe	Hecla Bay Fm
DSt	Strathcona Fiord Fm
DBi	Bird Fiord Fm
DBiC	Bird Fiord Fm Carbonate Equivalent
S/DUC	Silurian/Devonian Carbonates
⇨	measured section (meters)
➡	spot locality
....	covered contact
-----	fault

5 of 5

DES LEVÉS ET DE LA CARTOGRAPHIE.
GIE, DES MINES ET DES RESSOURCES.
indiqués au diagramme. Publiée en 1984

ente au Bureau des Cartes du Canada.
e, des Mines et des Ressources, Ottawa.
plus près

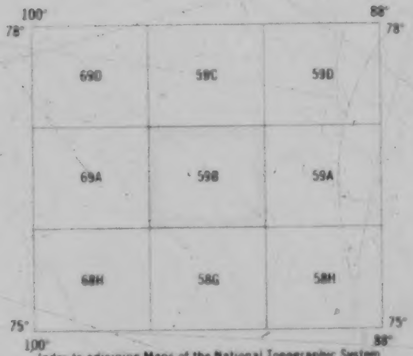
te La Reine du Chef du Canada
nergie, des Mines et des Ressources

S ÉCHELLE DE CONVERSION DES ALTITUDES

150 200 250 300 Mètres

400 500 600 700 800 900 1000 Pieds

EQUIDISTANCE DES COURBES 100 PIEDS
Altitudes en pieds
Système de référence géodésique nord-américain, 1927
Projection transverse de Mercator



Index to adjoining Maps of the National Topographic System
Tableau d'assemblage du Système national de référence cartographique

PRINCE ALFRED BAY
59 B
EDITION 2 ÉDITION

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canad

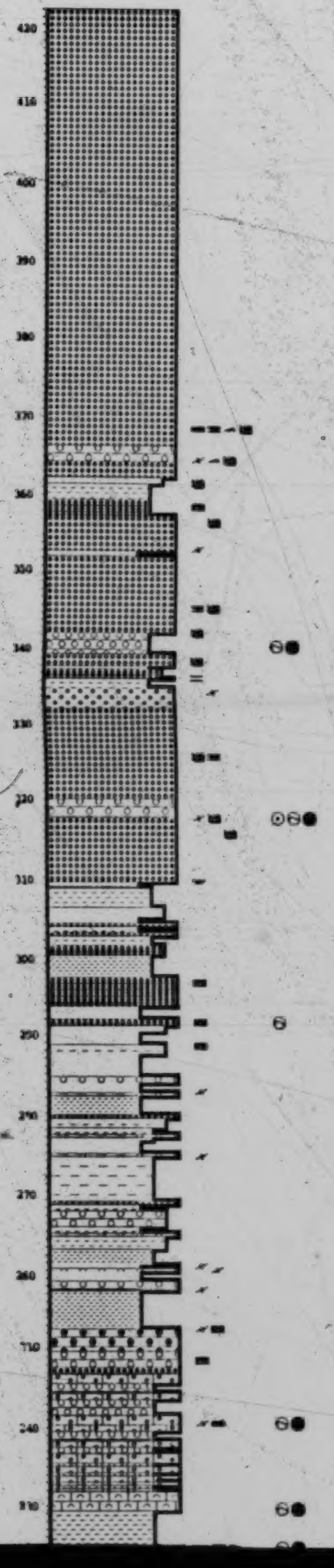
918 EAST COAST OF NORTH KENT ISLAND

GSC1, GOOSE FIORD, ELLESMERE ISLAND

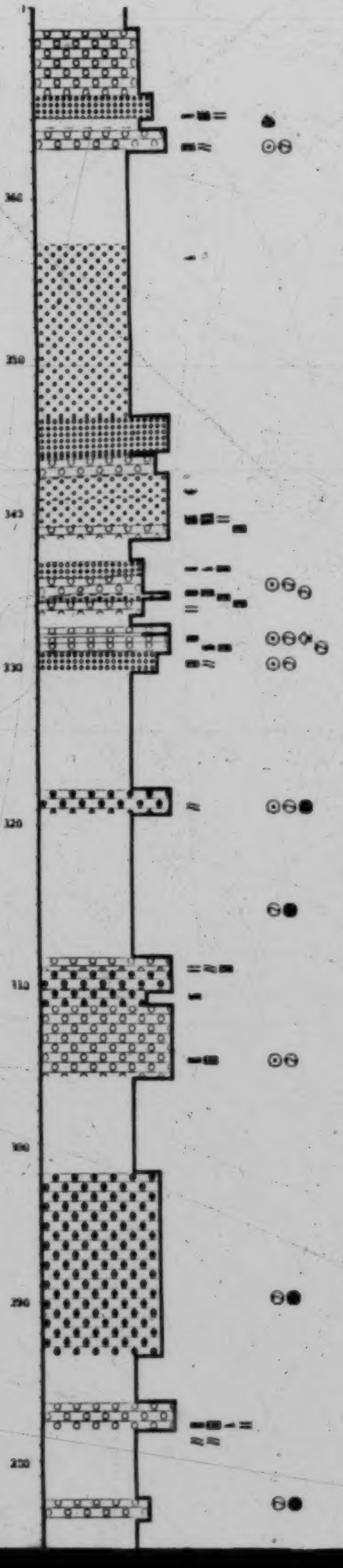
1979 GOOSE FIORD, GOOSE FIORD B. JONES AND G. GOODBODY

1oF

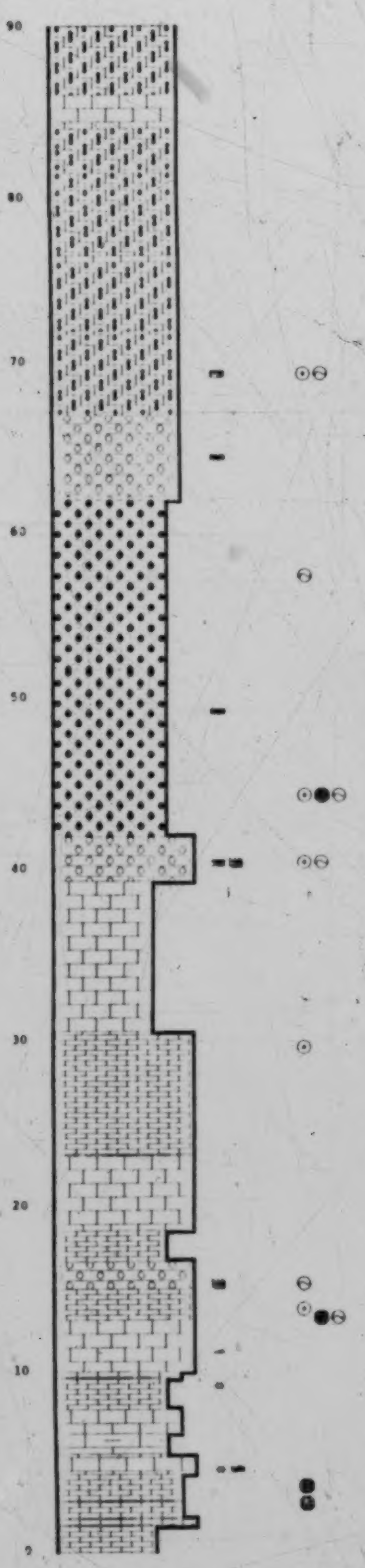
76 36 00 N 89 53 00 W


420
410
400
390
380
370
360
350
340
330
320
310
300
290
280
270
260
250
240
230

76 38 10 N 88 21 30 W

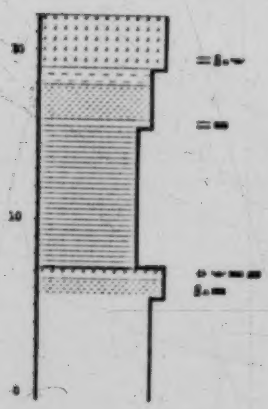

360
350
340
330
320
310
300
290
280

76 39 30 N 88 25 00 W


90
80
70
60
50
40
30
20
10
0

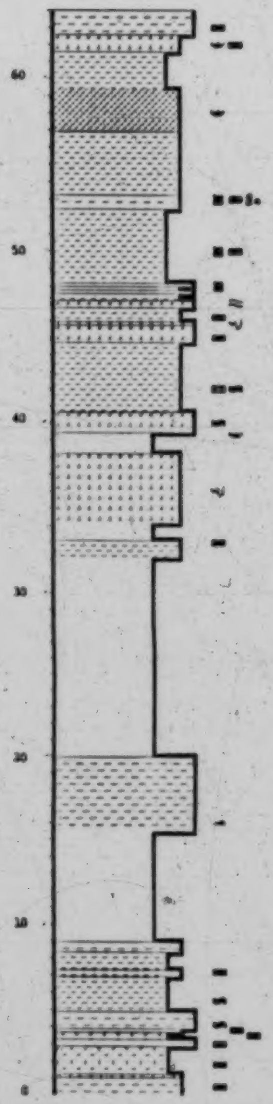
ECTION 82A1, MUSKOX FIORD, ELLESMERE ISLAND

76 39 45 N 87 52 30 N



82B1, MUSKOX FIORD, ELLESMERE ISLAND

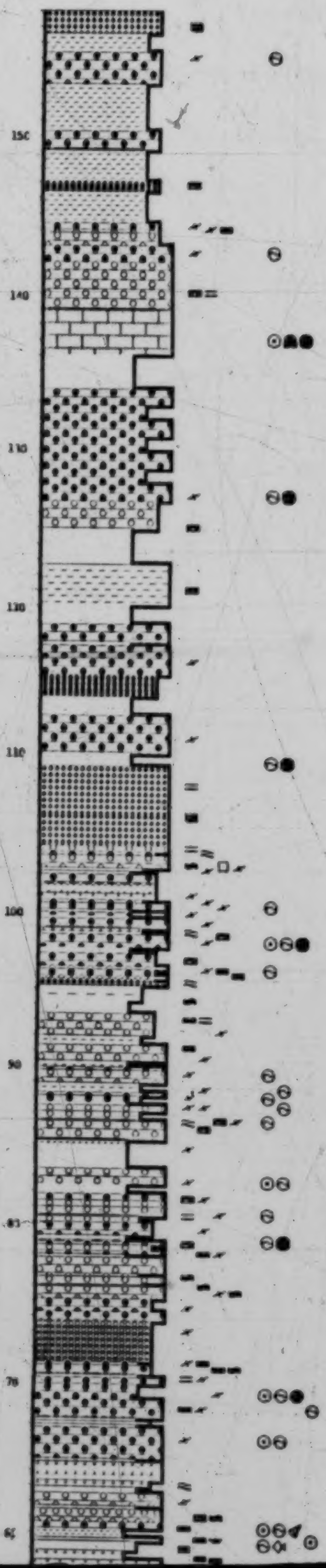
76 41 50 N 87 42 00 W


60
50
40
30
20
10
0

82B4, MUSKOX FIORD, ELLESMERE ISLAND

2oF

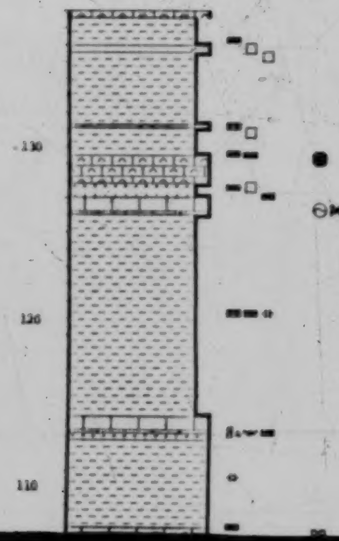
76 42 10 N 87 32 00 W


150
140
130
120
110
100
90
80
70
60

82A1, MUSKOX FIORD, ELLESMERE ISLAND

82A2, MUSKOX FIORD, ELLESMERE ISLAND

76 40 00 N 87 52 30 W

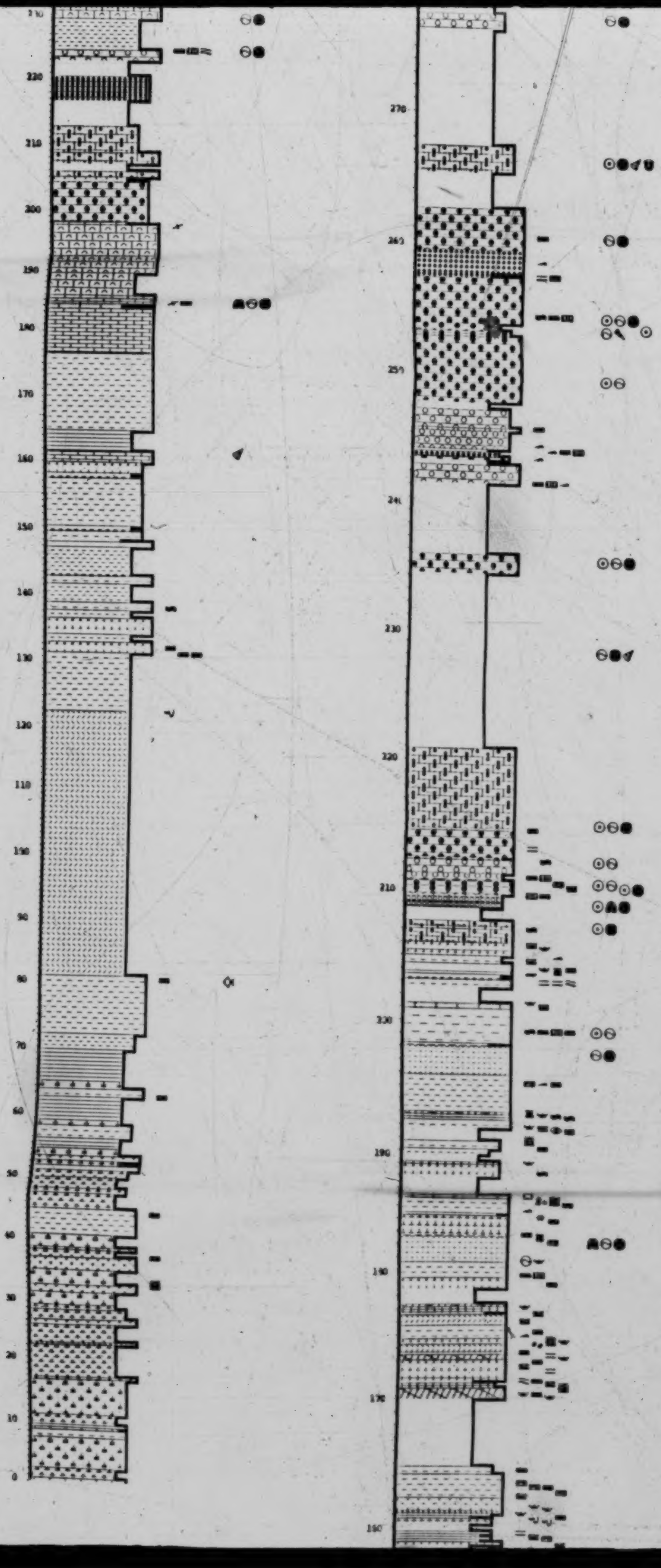


82B1, MUSKOX FIORD, ELLESMERE ISLAND

82B2, MUSKOX FIORD, ELLESMERE ISLAND

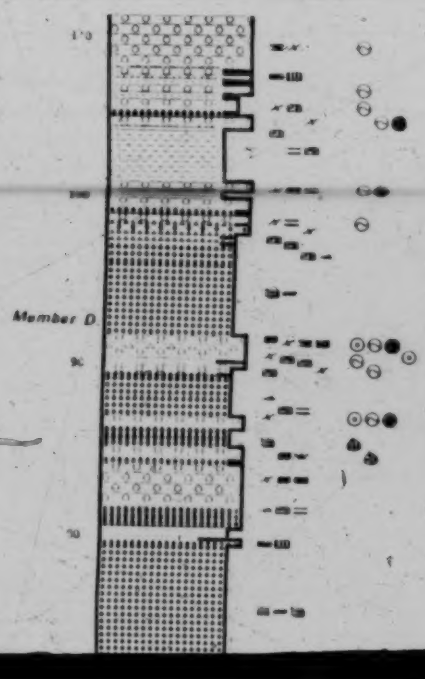
30F

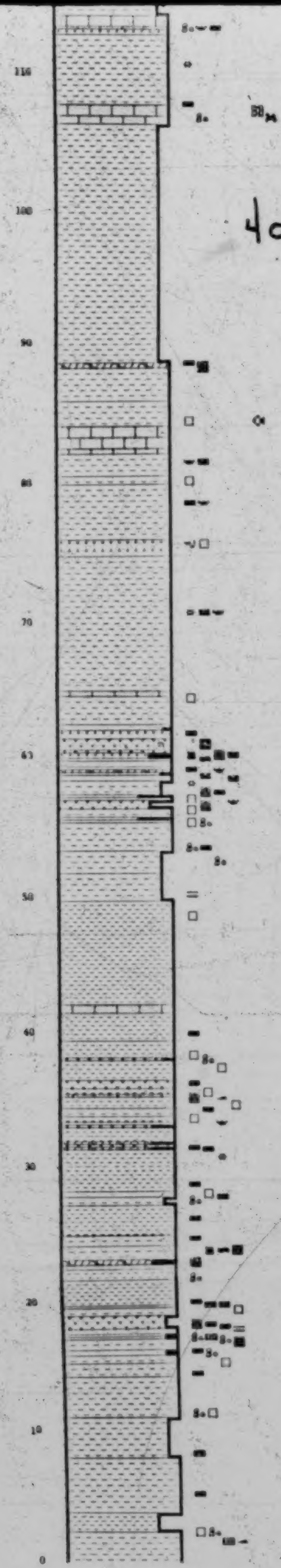
1979 GOOSE FIORD, GOOSE FIORD. B. JONES AND G. GOODBODY


0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
160
170
180
190
200
210
220
230
240
250
260
270

MJC, MUSKOX FIORD, ELLESMERE ISLAND

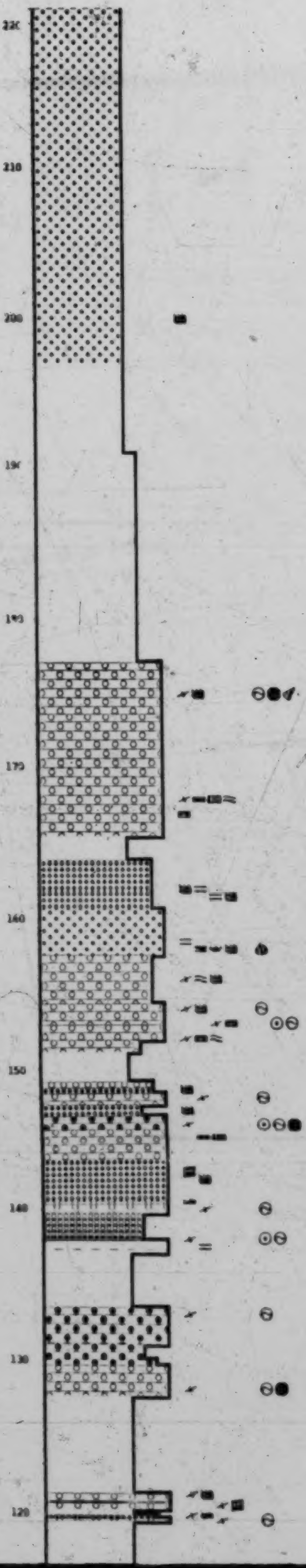
76 41 00 N 88 30 00 W

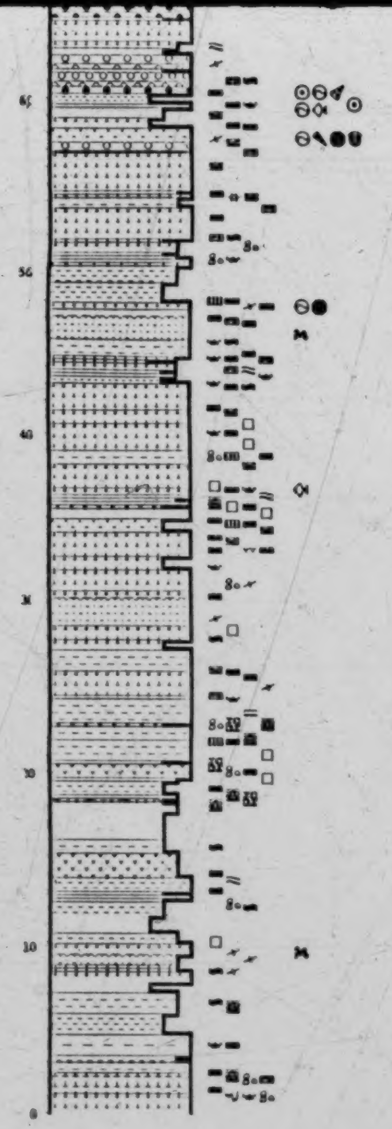

Member D
70
90
100
110


110
100
90
80
70
60
50
40
30
20
10
0

4 OF

76 41 50 N 87 41 00 W

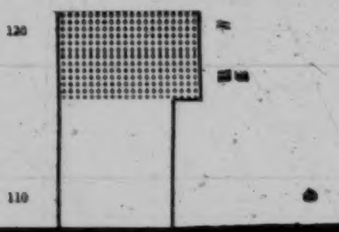

220
210
200
190
180
170
160
150
140
130
120


60
50
40
30
20
10
0

[illegible], MUSKOX FIORD, ELLESMERE ISLAND

[illegible], NORTH EAST OF HEAD OF BAAD FIORD, ELLESMERE ISLAN

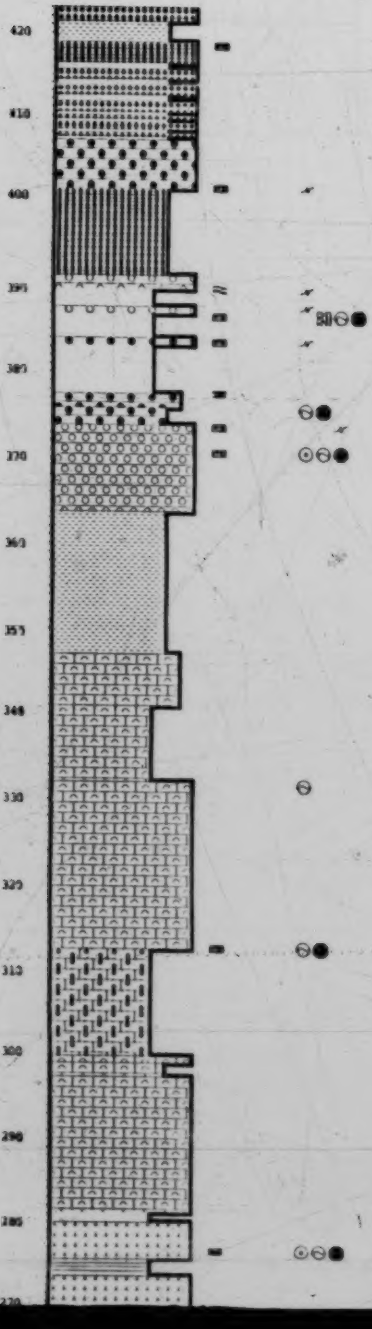
76 50 00 N 86 47 00 W

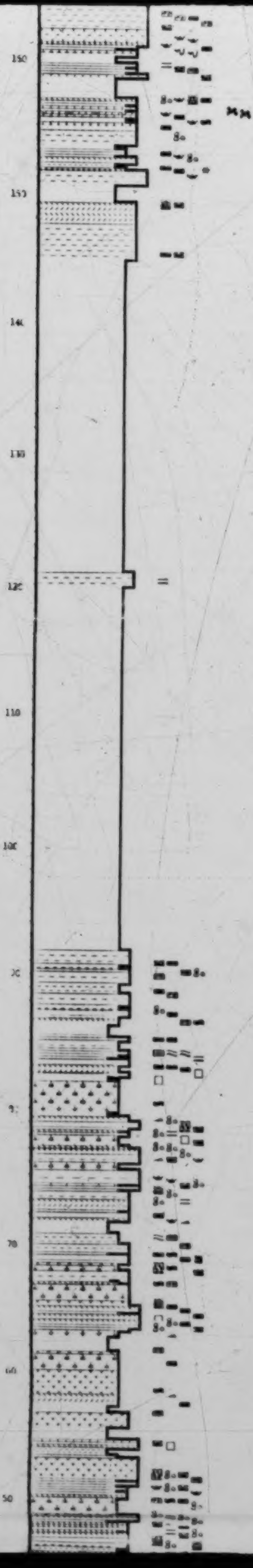


81B EAST COAST OF NORTH KENT ISLAND

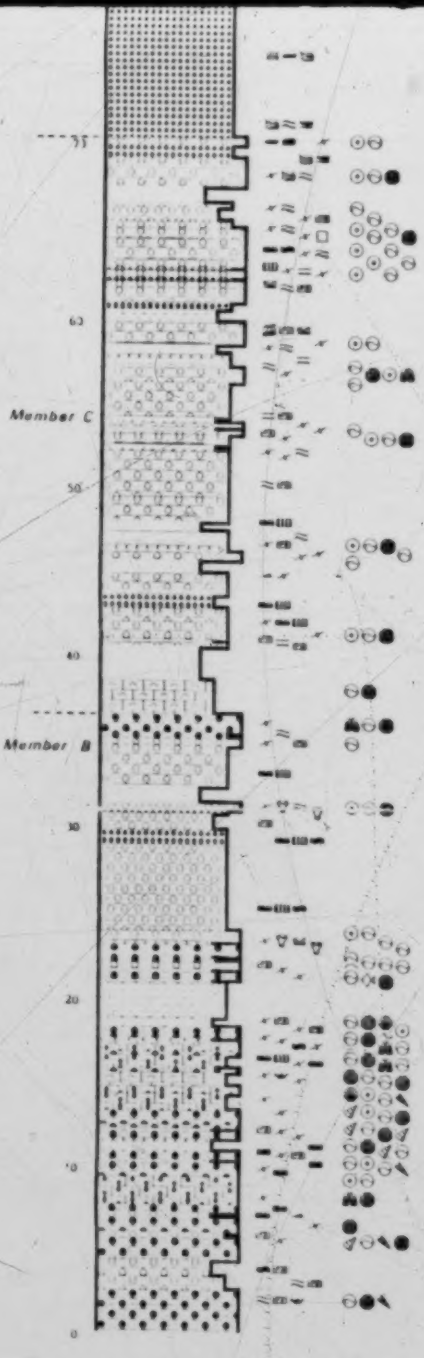
I 81G, BLUBBER POINT (HELL GATE) S.W. ELLESMERE

76 36 00 N 89 40 00 W


420
410
400
390
380
370
360
350
340
330
320
310
300
290
280


150
140
130
120
110
100
90
80
70
60
50

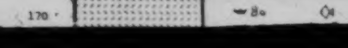
δ'OF


Member C
Member B
60
50
40
30
20
10
0

82C, [illegible] FIORD, ELLESMERE ISLAND

I 82A, [illegible] FIORD, ELLESMERE ISLAND

76 39 20 N 87 52 30 W

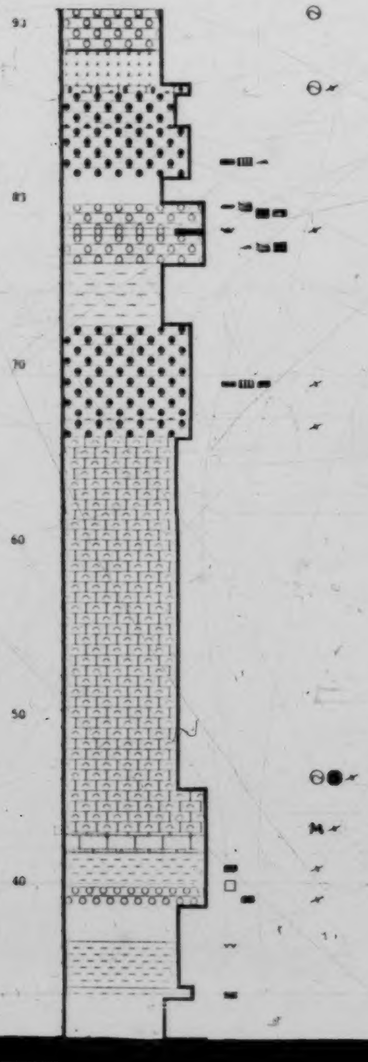


S 8242, HUDSON FIORD, ELLESMERE ISLAND

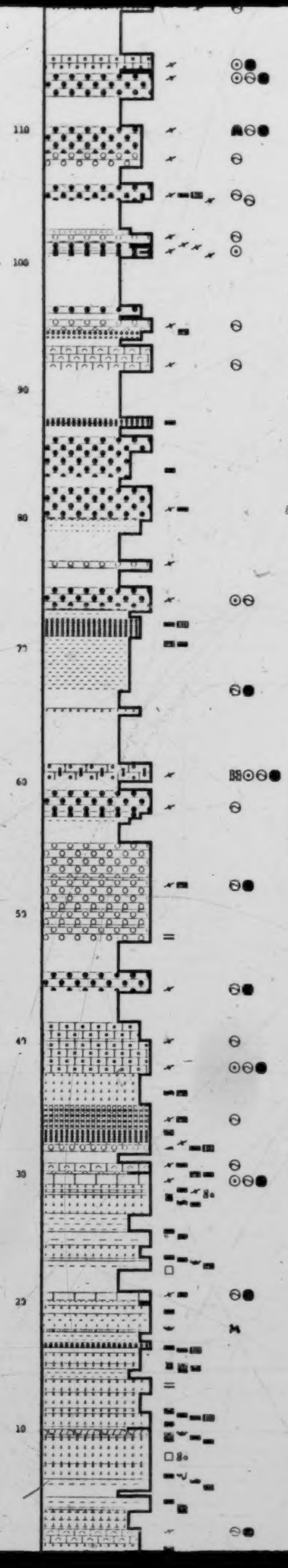
6 oF

8243, HUDSON FIORD, ELLESMERE ISLAND

76 40 02 N 87 52 30 W



91
80
70
60
50
40



110
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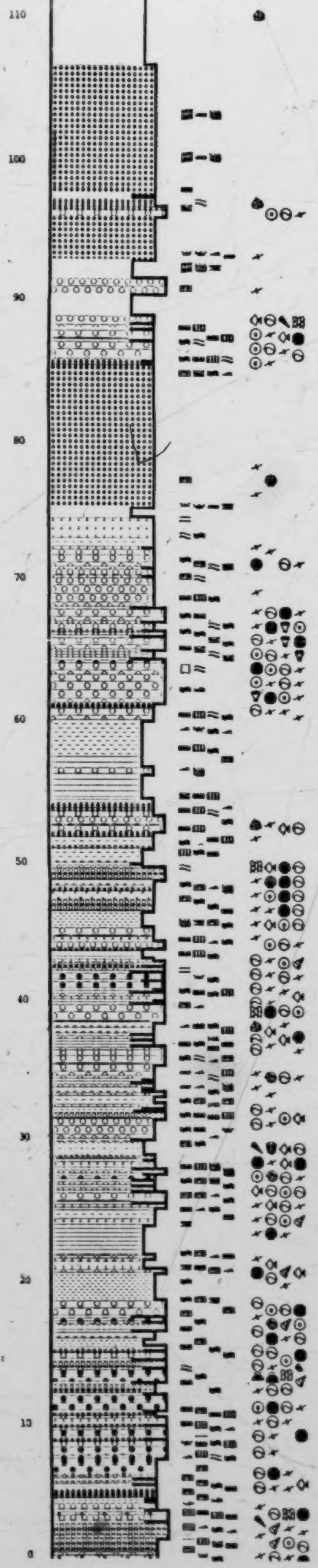
80
77
60
50
40
30
20
10



110
100
90
80
70
60
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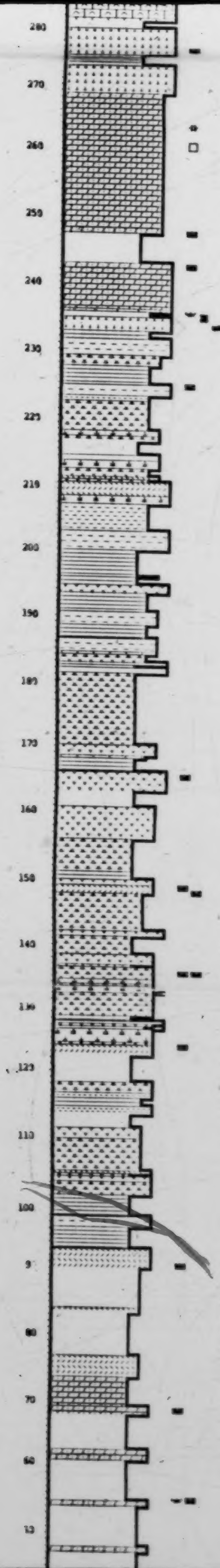
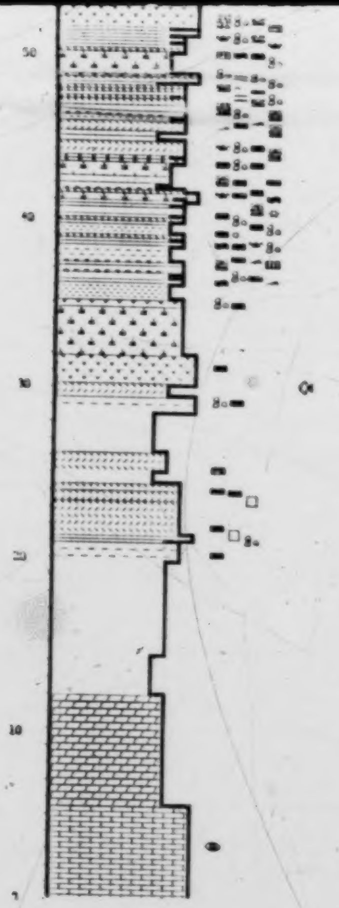
40
30
20
10
0



280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50



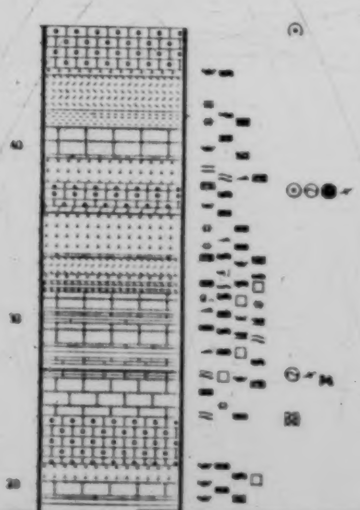
50
40
30
20
10

7oF

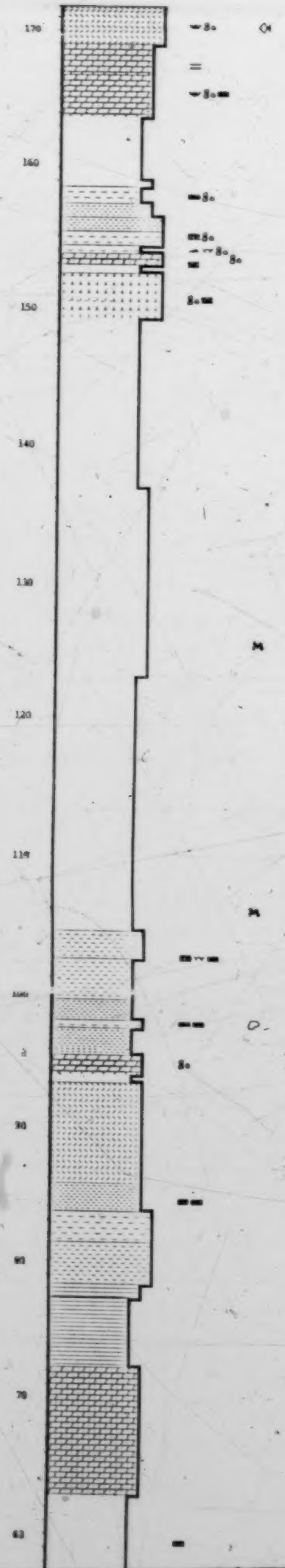
82C1, GOOSE FIORD, ELLESMERE ISLAND

82C1/83, GOOSE FIORD, ELLESMERE ISLAND. Q. H. GOODBODY 1983

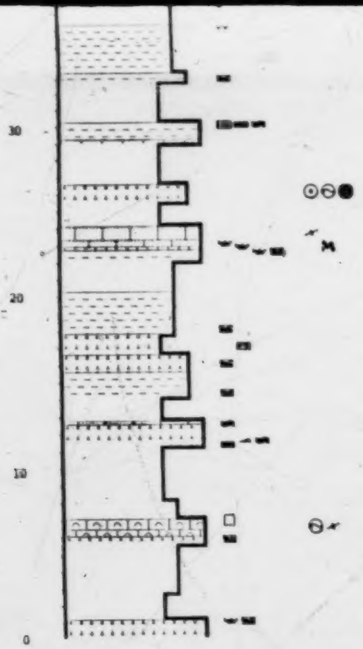
76 38 10 N 88 21 30 W

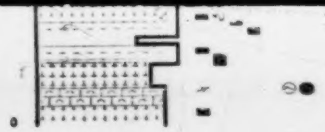


76 39 20 N 87 52 30 W



170
160
150
140
130
120
110
100
90
80
70
60





834, NORTH EAST OF HEAD OF SAAB FIORD, ELLESMERE ISLAND

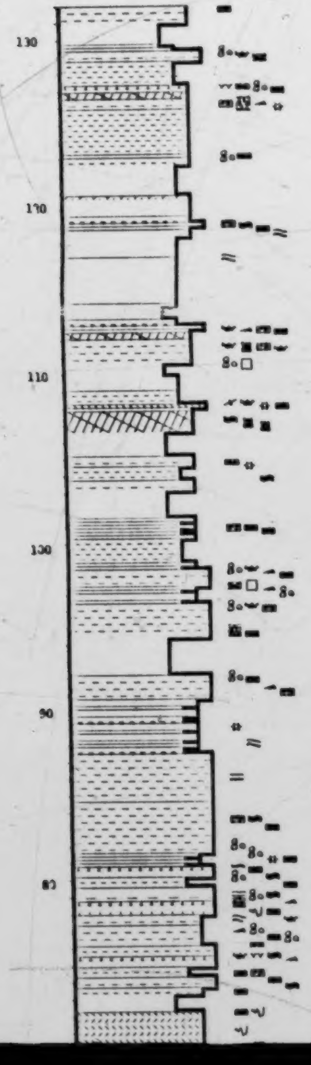
8282, MUSKOX FIORD, ELLESMERE ISLAND

I 8283, MUSKOX FIORD S.W. ELLESMERE

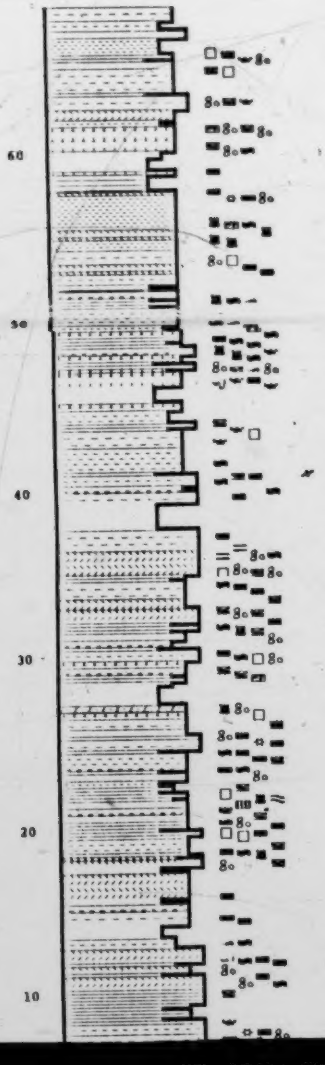
8oF

82A3, MUSKOX FIORD, ELLESMERE ISLAND

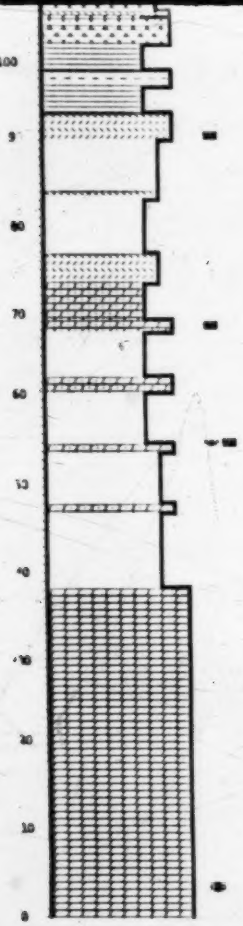
76 41 20 N 87 32 00 W

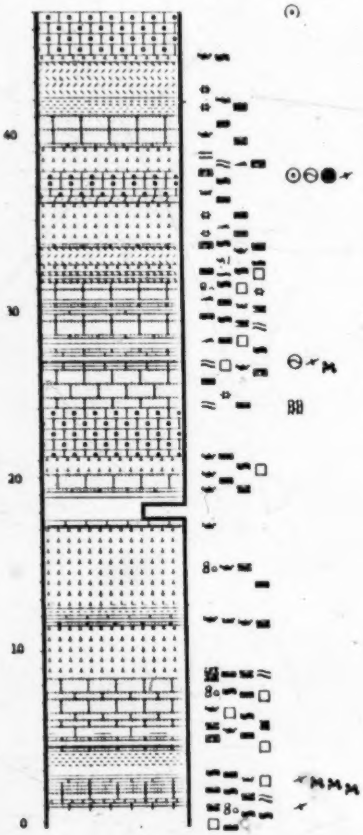

130
120
110
100
90
80

76 46 40 N 86 56 00 W


60
50
40
30
20
10

82B, MUSKOX FIORD, ELLESMERE ISLAND

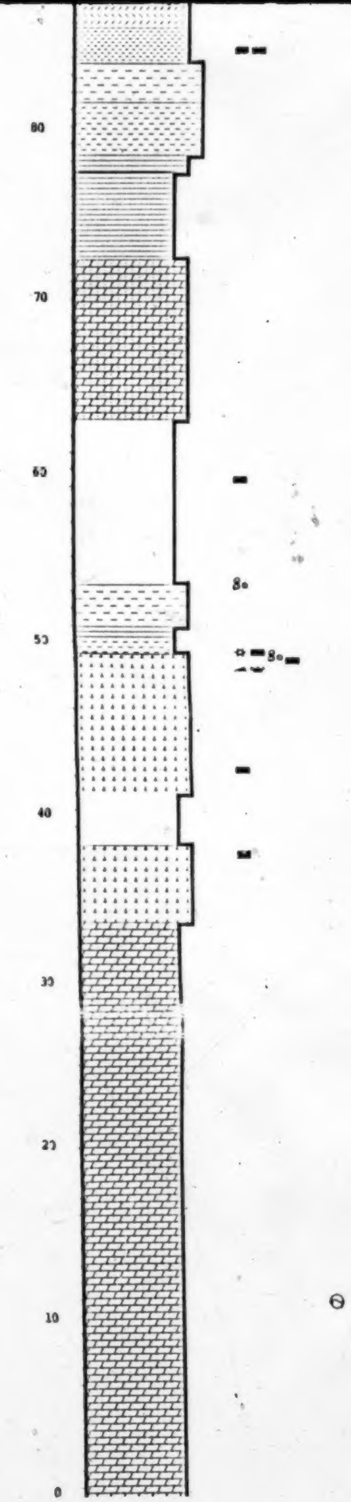

100
90
80
70
60
50
40
30
20
10
0



82C1/83, GOOSE FIORD, ELLESMERE ISLAND. Q. H. GOODBODY 1983

81G, BLUBBER POINT (HELL GATE) S.W. ELLESMERE

9oF

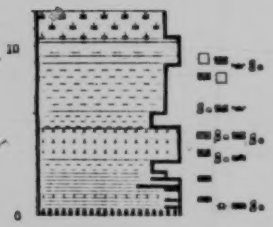

80
70
60
50
40
30
20
10
0

ELLESMERE ISLAND

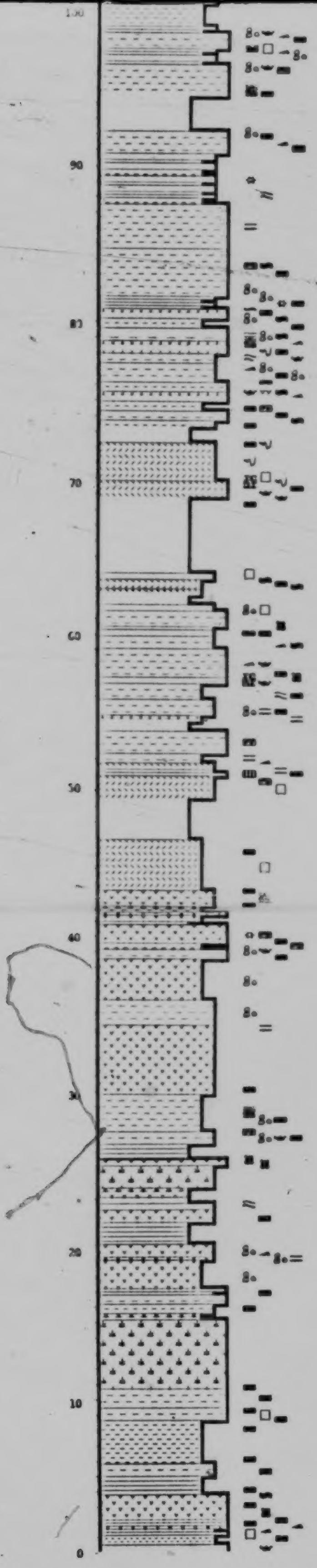
82A, MUSKOX FIORD, ELLESMERE ISLAND

829, MUSKOX FIORD, ELLESMERE ISLAND

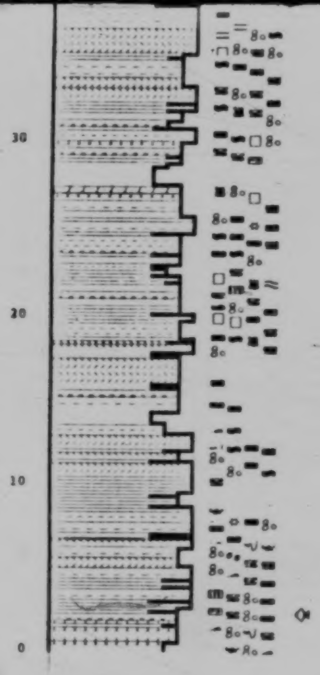
76 41 48 N 87 42 00 W



829, MUSKOX FIORD, ELLESMERE ISLAND


100
90
80
70
60
50
40
30
20
10
0

I 8283, MUSKOX FIORD S.W. ELLESMERE



1983 B, N.E. OF HEAD OF BAAD FIORD, ELLESMERE ISLAND.

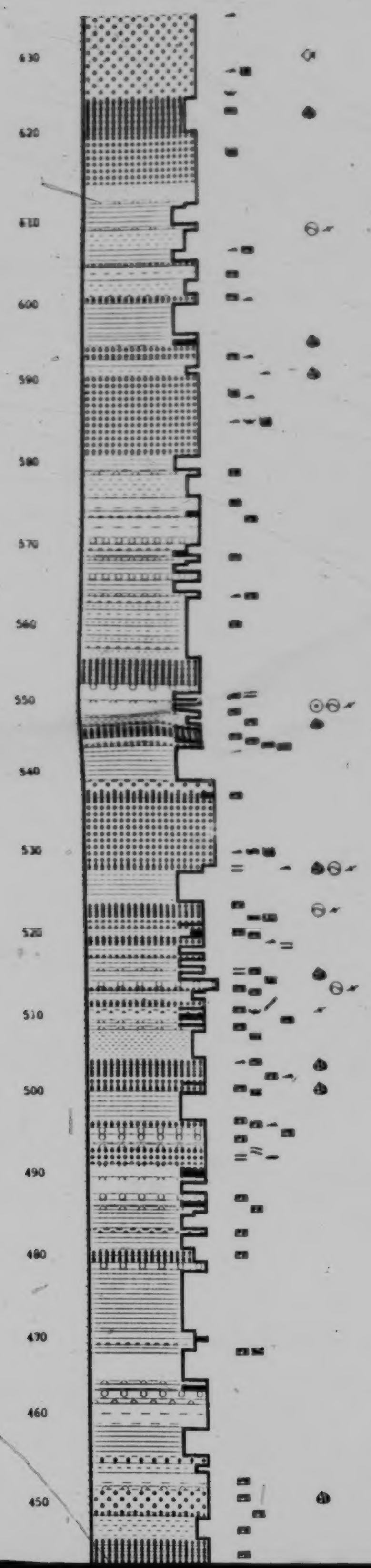
100A0

I 1980 XII, DUNDEE BIGHT, BATHURST ISLAND

1980 I, DUNDEE BIGHT, BATHURST ISLAND. Q.H.GOODBODY

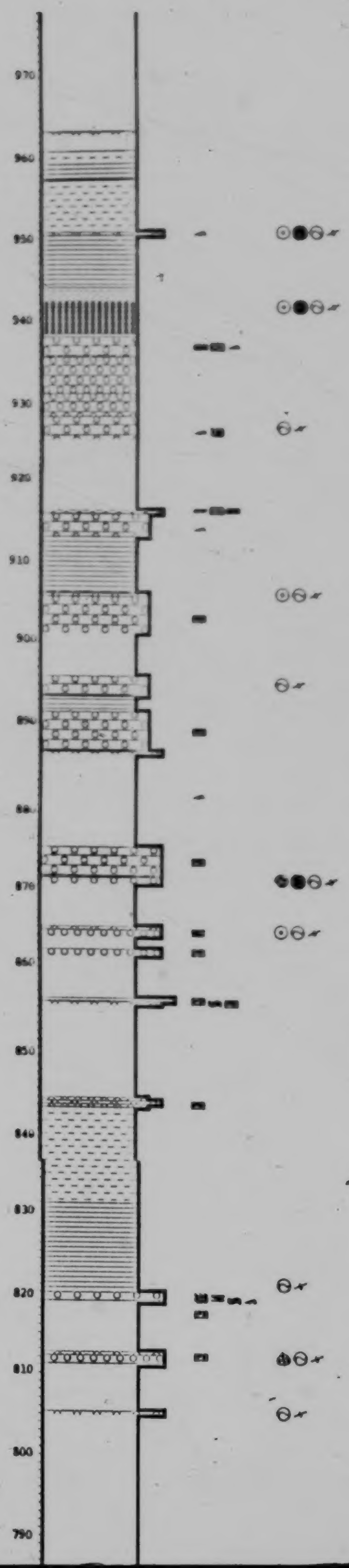
1oF

75 50 00 N 100 10 00 W



630
620
610
600
590
580
570
560
550
540
530
520
510
500
490
480
470
460
450

75 57 00 N 99 57 00 W



970
960
950
940
930
920
910
900
890
880
870
860
850
840
830
820
810
800
790

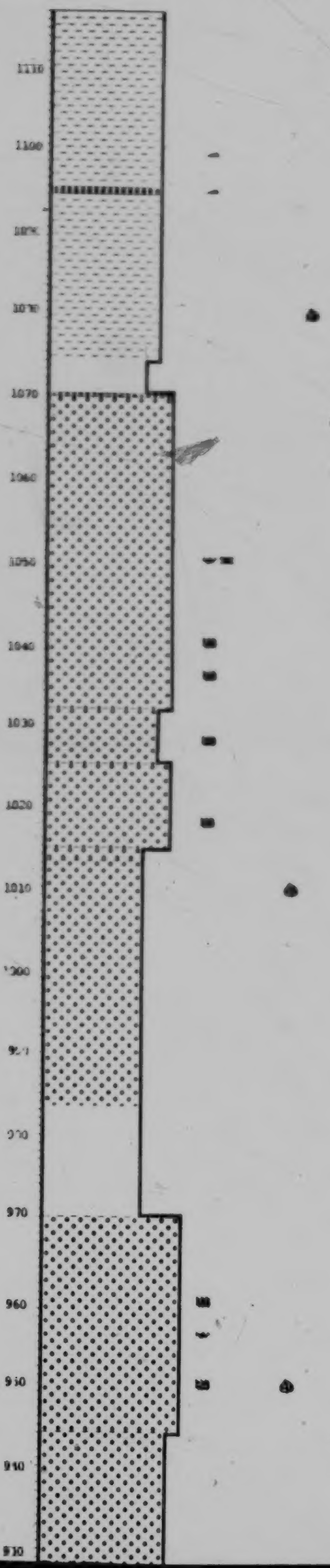
ECTION 1980 I, DUNDEE BIGHT BATHURST ISLAND. Q.H. GOODBODY 1980

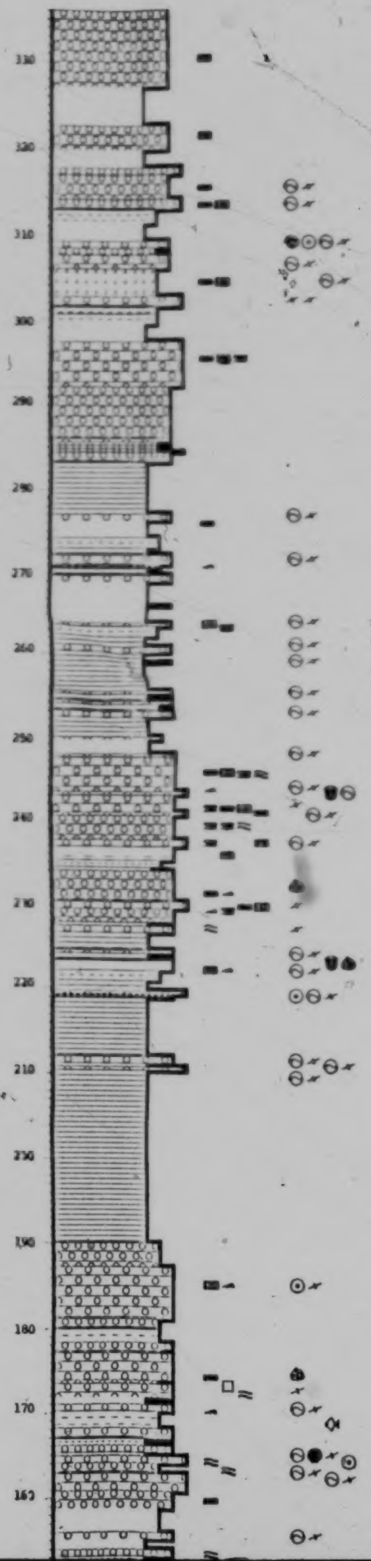
1980 II, STUART BAY, BATHURST ISLAND

76 03 00 N 100 07 00 W

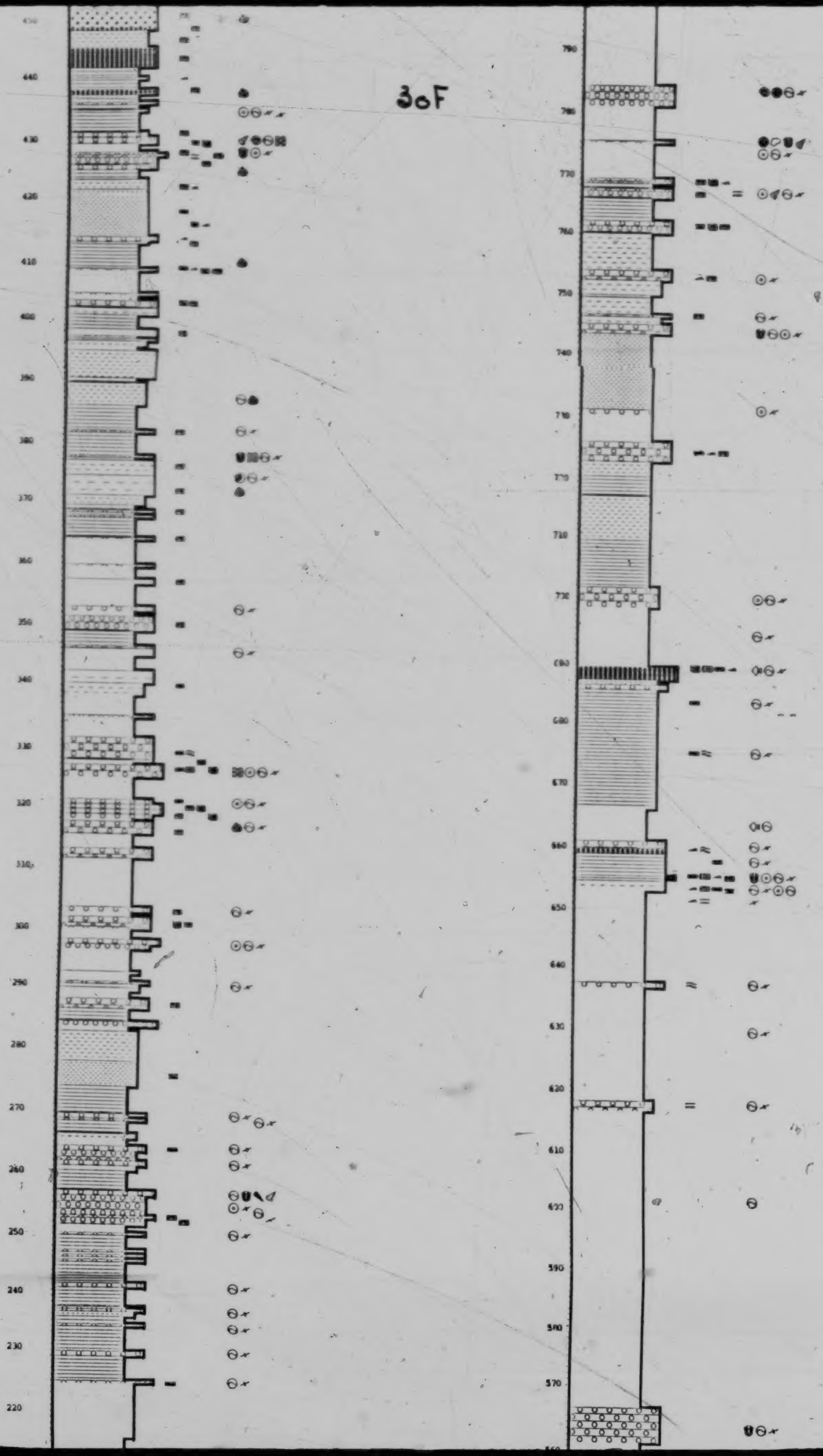
76 11 00 N 100 00 00 W

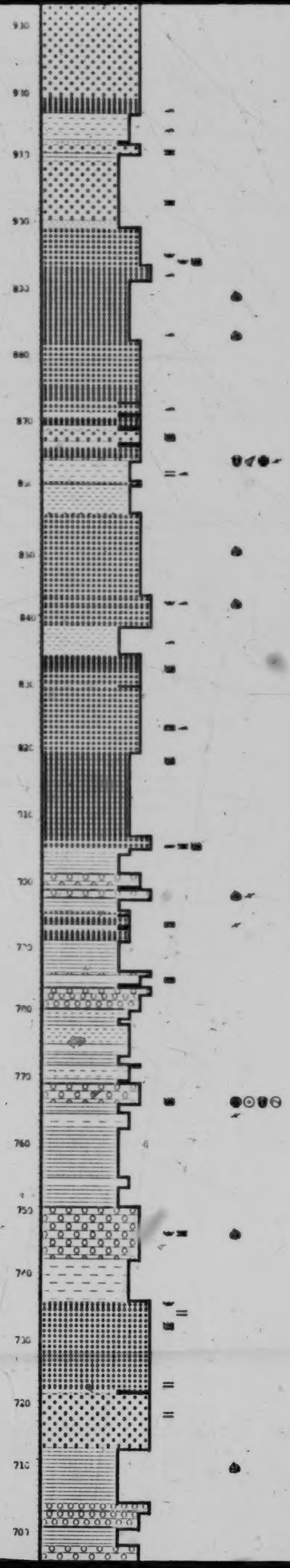
20F


1110
1100
1090
1080
1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
960
950
940
930


330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160

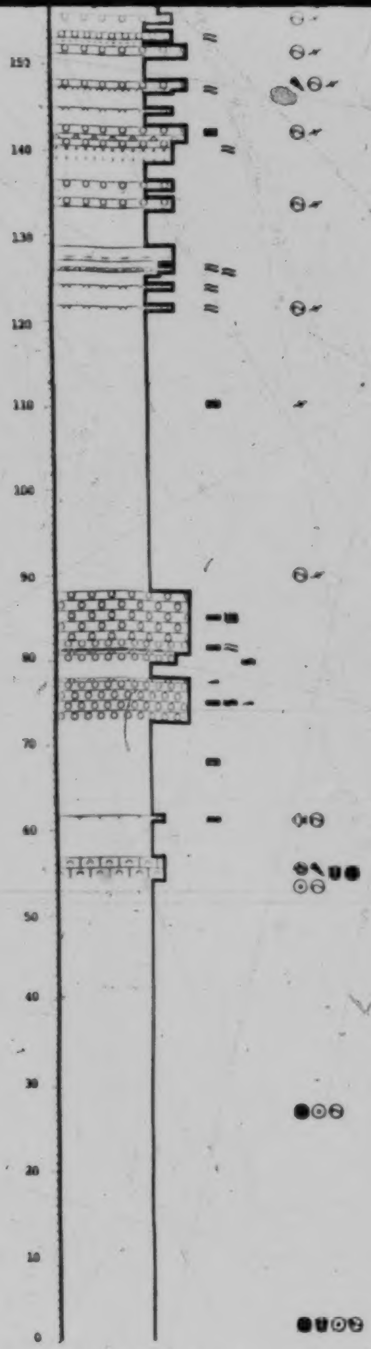
3oF





930
910
900
890
880
870
850
840
820
800
790
780
770
760
750
740
730
720
710
700

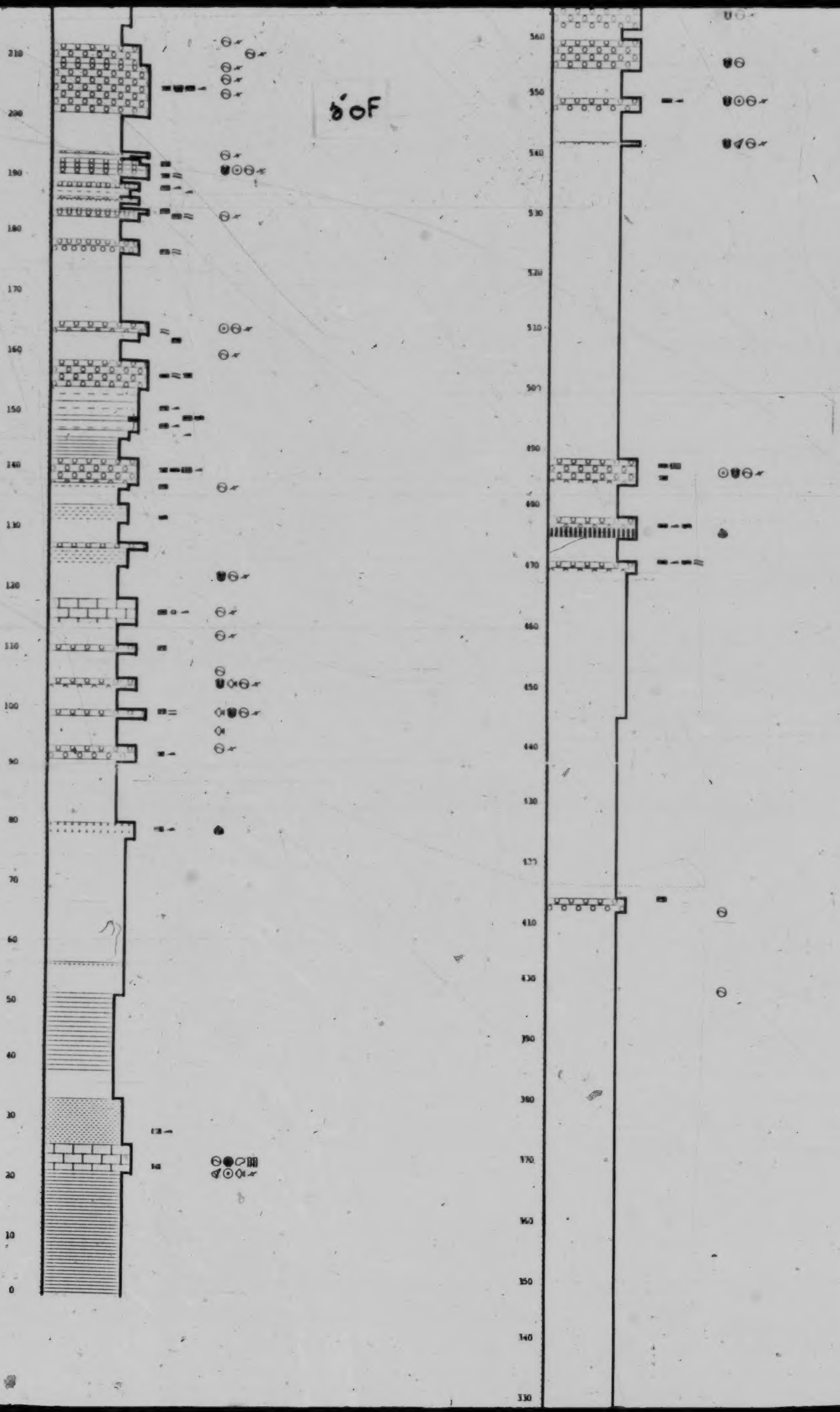
4OF

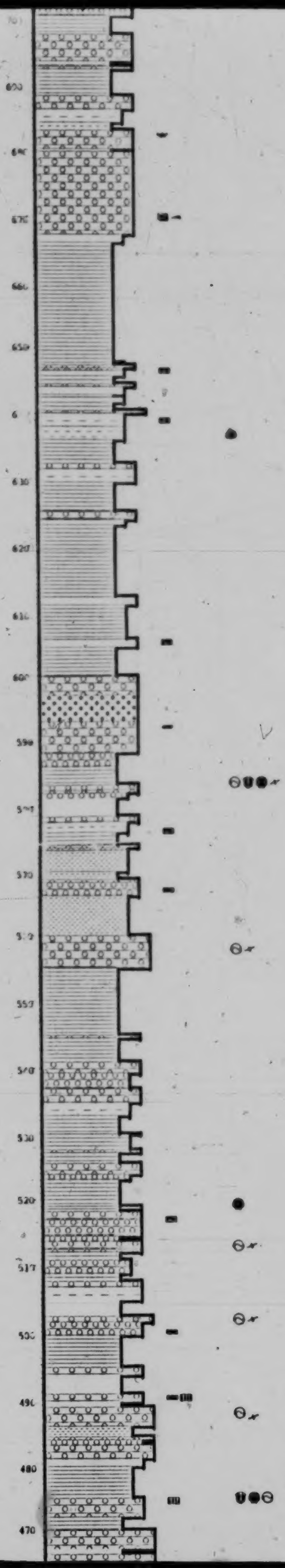


150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

I 1000 XI, STUART BAY, BATHURST ISLAND

8 OF





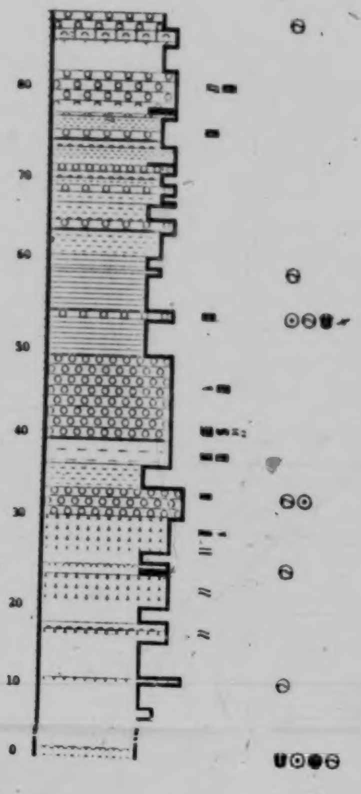
6 oF

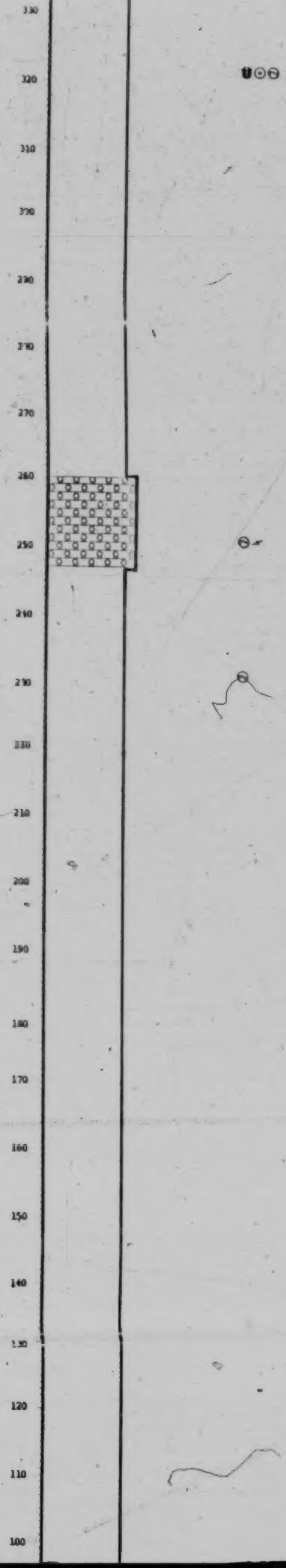
7oF

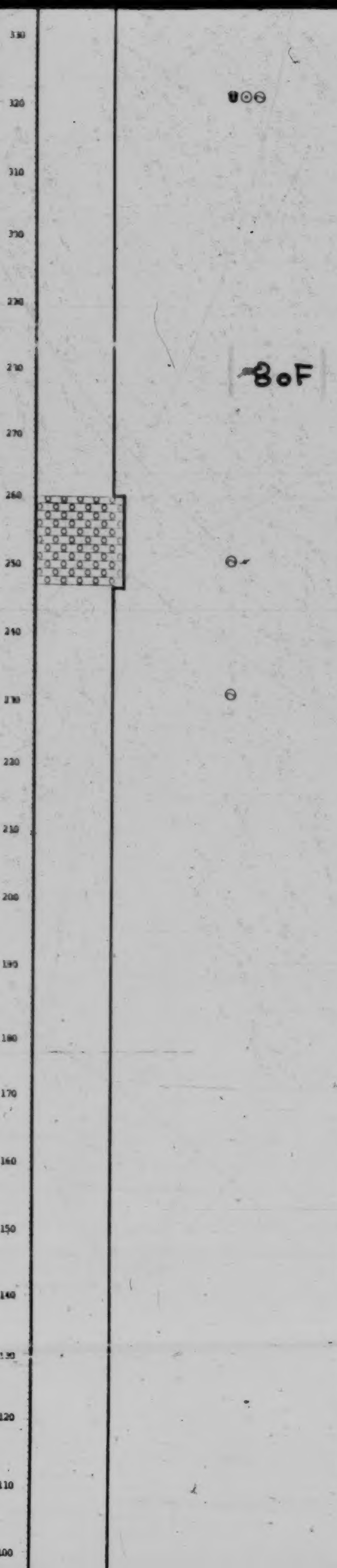
1000 XII, DUNDEE BIGHT, BATHURST ISLAND

1000 XIII, DUNDEE BIGHT, BATHURST ISLAND

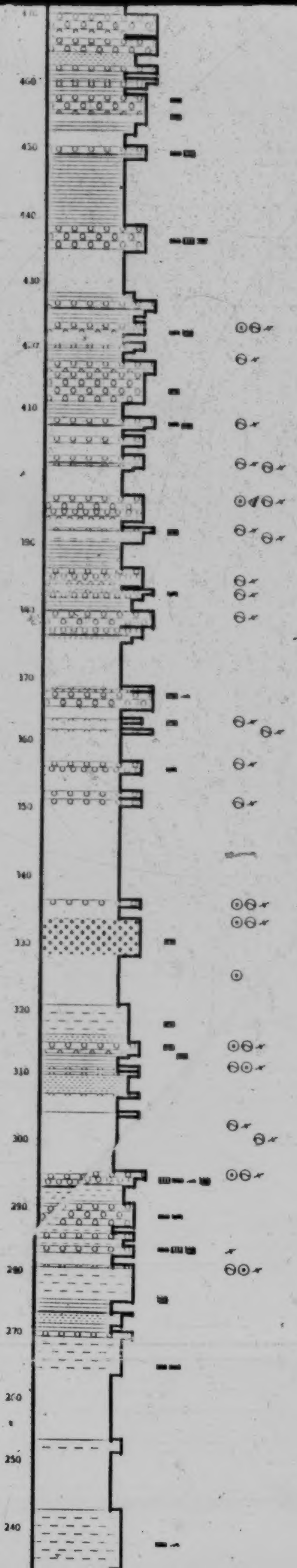
75 55 00 N 99 57 00W


80
70
60
50
40
30
20
10
0


330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100



8oF

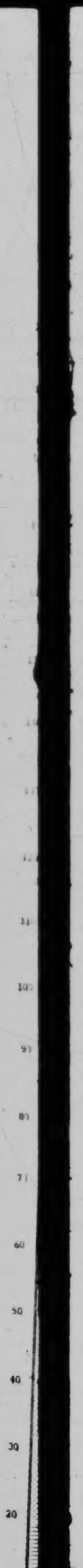


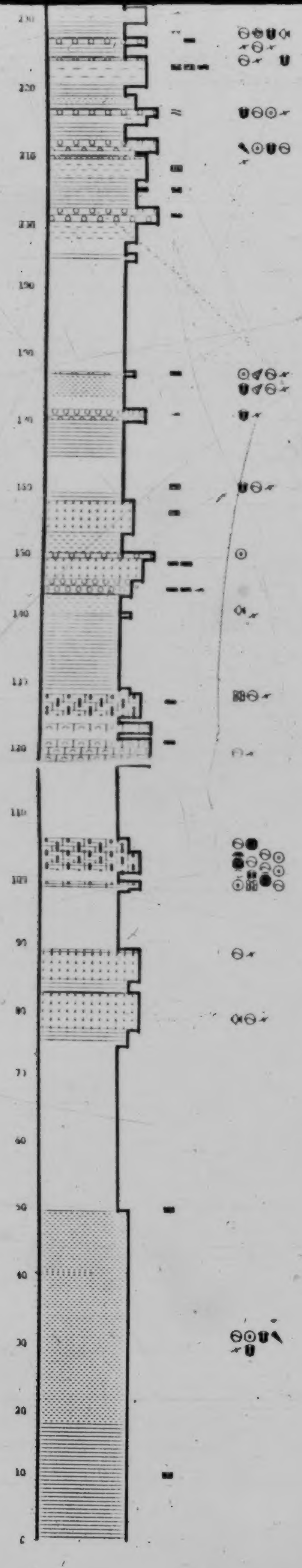
[illegible] XIII, DUNDEE BIGHT, BATHURST ISLAND

90F

[illegible] I, DUNDEE BIGHT, BATHURST ISLAND. [illegible]

BATHURST ISLAND



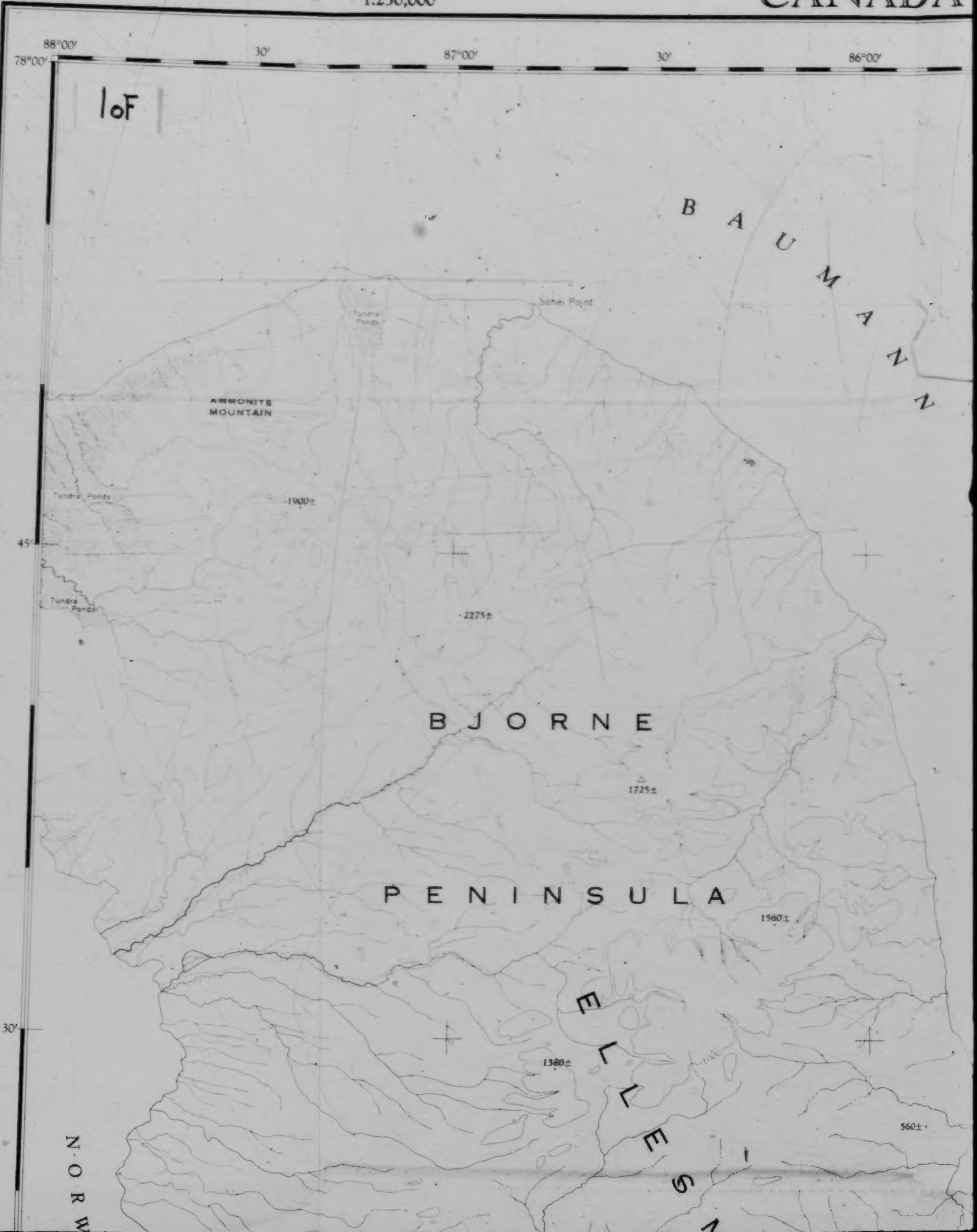


100F10

49 C

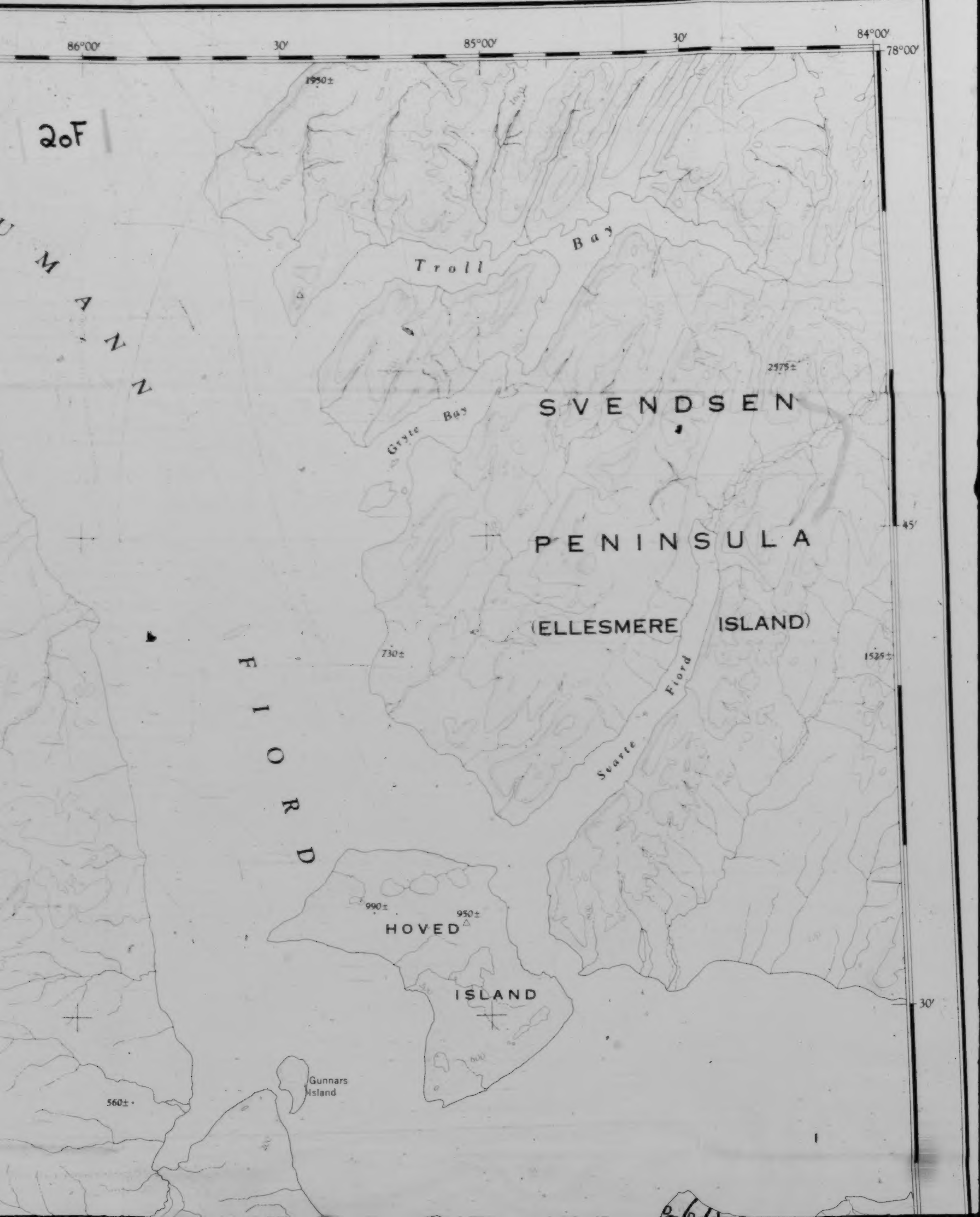
1:250,000

CANADA

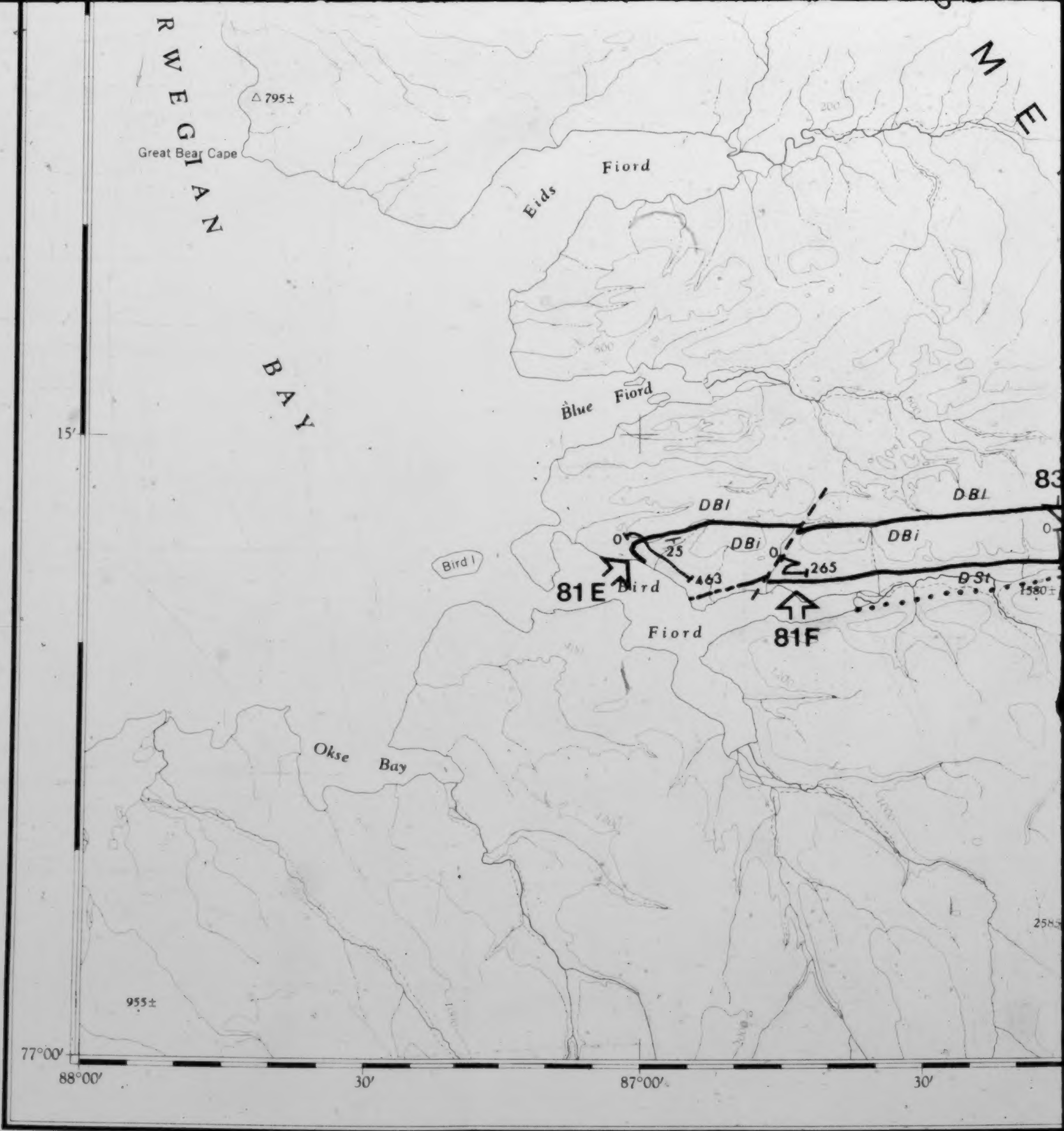

88°00′
78°00′
30′
87°00′
30′
86°00′
45′
30′
B A U M A N N
Scher Point
Tundra Ponds
AMMONITE MOUNTAIN
Tundra Ponds
1900±
Tundra Ponds
2275±
B J O R N E
1725±
P E N I N S U L A
1560±
E L L E S
1380±
1000
560±
500
N O R W

1oF

CANADA EDITION 1 49 C


86°00′
30′
85°00′
30′
84°00′
78°00′
1950±
20F
U M A N N
Troll Bay
2575±
SVENDSEN
PENINSULA
(ELLESMERE ISLAND)
Gryte Bay
45′
730±
F I O R D
Svarte Fiord
1525±
990±
950±
HOVED
ISLAND
30′
Gunnars Island
560±

30F


RWEGIAN
BAY
ME
△795±
Great Bear Cape
Eids Fiord
Blue Fiord
Bird I
Bird Fiord
Okse Bay
DBl
DBi
DSt
81E
81F
83
0
25
463
265
1580±
955±
258±
15′
77°00′
88°00′
30′
87°00′
30′

ELIABILITY DIAGRAM - CROQUIS D'EXACTITUDE

A - Compiled, photogrammetrically, from 1959 aerial photography

A - Rédigée photogammétriquement d'après des photographies aériennes prises en 1959.

Produced, 1965-66, by the **SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES.** Field surveys 1961. Printed 1967.

The daily change of the North Magnetic Pole renders the magnetic compass unreliable in this area. Magnetic declination 1966 varies from 101°20′ westerly at centre of west edge to 95°32′ westerly at centre of east edge.

Copies may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa, or your nearest map dealer.

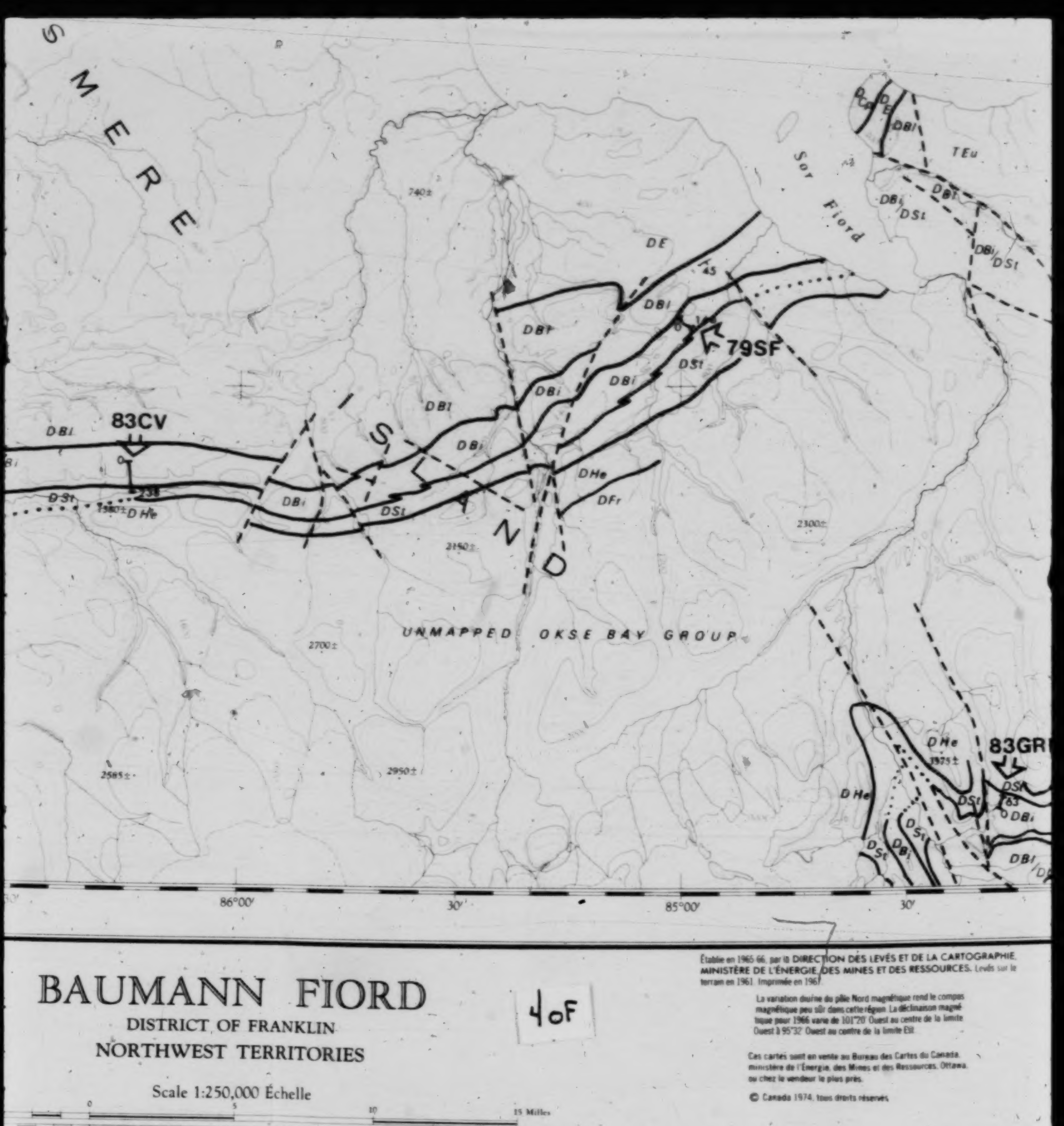
© Canada Copyrights Reserved 1974

BAU

N

Miles 5
0
Kilometres 5
0

Transverse Mercator Projection
North American Datum 1927
Contour interval 200 feet
Elevations in feet above Mean Sea Le


S M E R E
I S L A N D
Sor Fiord
DE
DBI
DBi
DSt
DHe
DFr
TEu
D E
D Or
45
83CV
79SF
83GR
238
1980±
740±
2150±
2300±
2700±
2950±
2585±
1975±
63
UNMAPPED OKSE BAY GROUP
86°00′
30′
85°00′
30′

BAUMANN FIORD

DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES

4oF

Scale 1:250,000 Échelle

0 5 10 15 Milles
0 5 10 15 20 Kilomètres

nsverse Mercator Projection
rth American Datum 1927
ntour interval 200 feet
ns in feet above Mean Sea Level

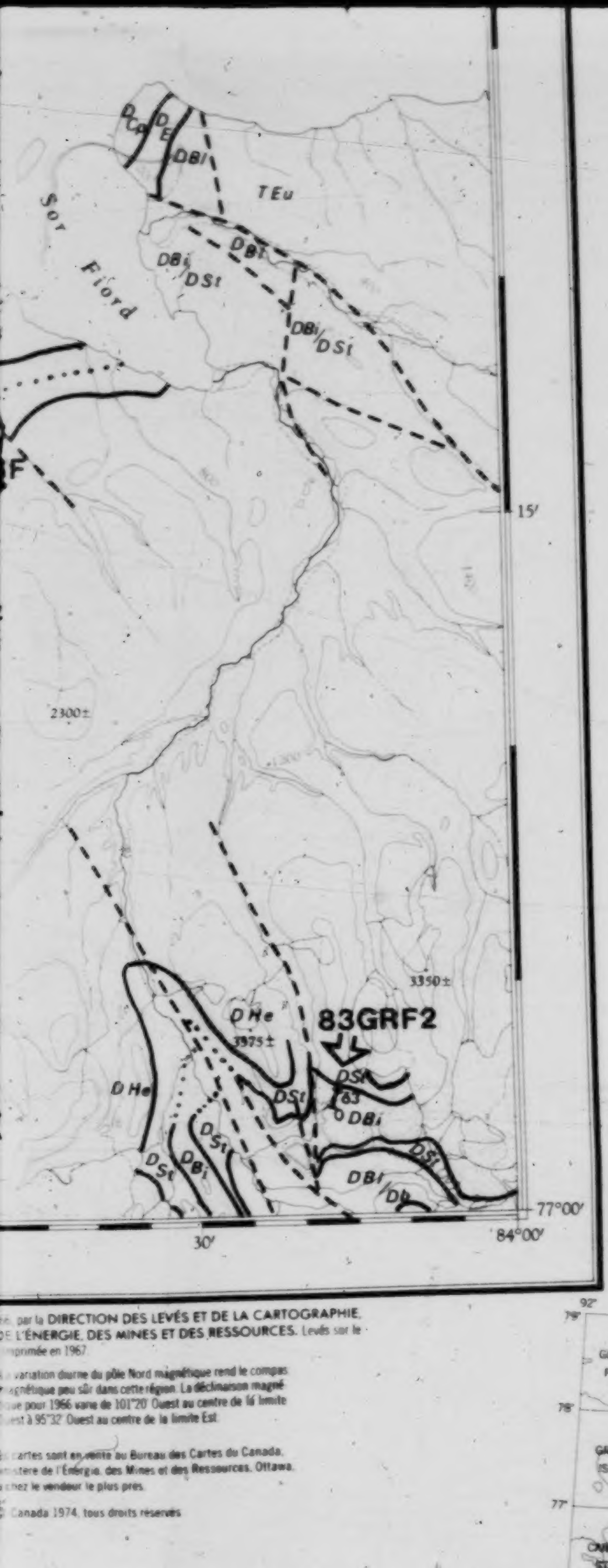
Projection Transverse de Mercator
Niveau de référence nord américain 1927
Équidistance des courbes 200 pieds
Élévations en pieds au dessus du niveau moyen de la mer

Établie en 1965 66, par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Levés sur le terrain en 1961. Imprimée en 1967.

La variation diurne du pôle Nord magnétique rend le compas magnétique peu sûr dans cette région. La déclinaison magnétique pour 1966 varie de 101°20′ Ouest au centre de la limite Ouest à 95°32′ Ouest au centre de la limite Est.

Ces cartes sont en vente au Bureau des Cartes du Canada, ministère de l'Énergie, des Mines et des Ressources, Ottawa, ou chez le vendeur le plus près.

© Canada 1974, tous droits réservés.


DCp
DE
DBl
TEu
Sor Fiord
DBl
DBi/DSt
DBi/DSt
F
15'
2300±
3350±
DHe
3975±
83GRF2
DSt
783
DBi
DHe
DSt
DSt
DBi
DSt
DBl/Db
DSt
77°00'
30'
84°00'

ée, par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE,
DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Levés sur le
imprimée en 1967.

a variation diurne du pôle Nord magnétique rend le compas
magnétique peu sûr dans cette région. La déclinaison magné
ique pour 1966 varie de 101°20' Ouest au centre de la limite
uest à 95°32' Ouest au centre de la limite Est.

s cartes sont en vente au Bureau des Cartes du Canada,
nistère de l'Énergie, des Mines et des Ressources, Ottawa,
chez le vendeur le plus près.

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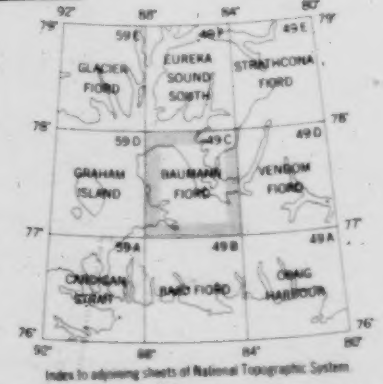
LEGEND

TEu	Eureka Sound Fm
DFr	Fram Fm
DHe	Hecla Bay Fm
DSt	Strathcona Fiord Fm
DBi	Bird Fiord Fm
DBi/DSt	Bird Fiord/Strathcona Fiord undifferentiated
DBl	Blue Fiord Fm
DBl/Db	Blue Fiord/Disappointment Bay Fm undifferentiated
DE	Eids
DCp	Cape Phillips Fm
⇨	measured section (meters)
·······	covered contact
- - - -	fault


92°
88°
84°
80°
79°
59 E
49 F
49 E
GLACIER FIORD
EUREKA SOUND SOUTH
STRATHCONA FIORD
78°
59 D
49 C
49 D
GRAHAM ISLAND
BAUMANN FIORD
VENDOM FIORD
77°
59 A
49 B
49 A
CARDIGAN STRAIT
BAAD FIORD
CRAIG HARBOUR
76°

Index to adjoining sheets of National Topographic System

Tableau d'assemblage du Système national de référence cartographique

5 of 5

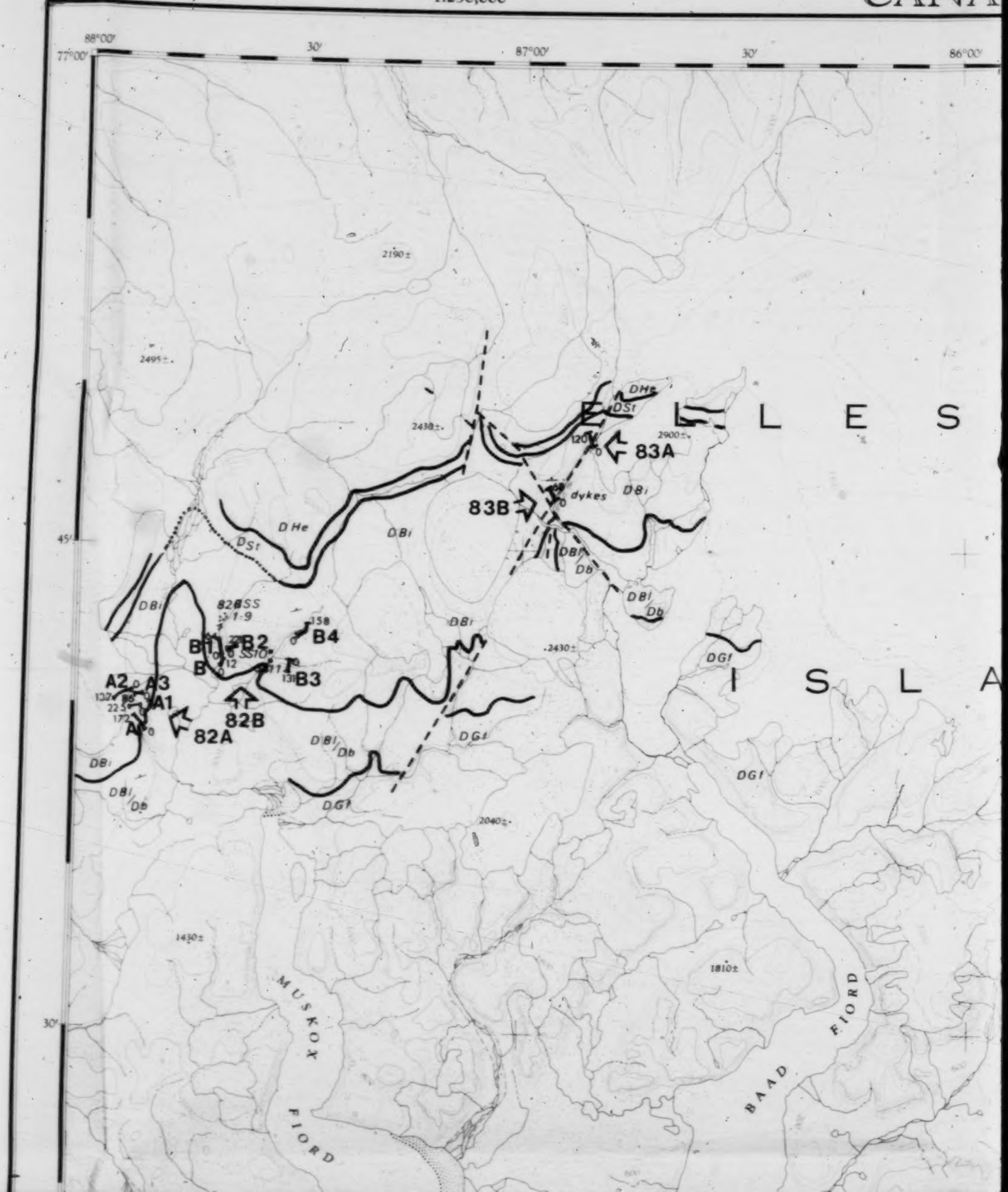
BAUMANN FIORD
49 C
EDITION 1

1oF

49 B

1:250,000

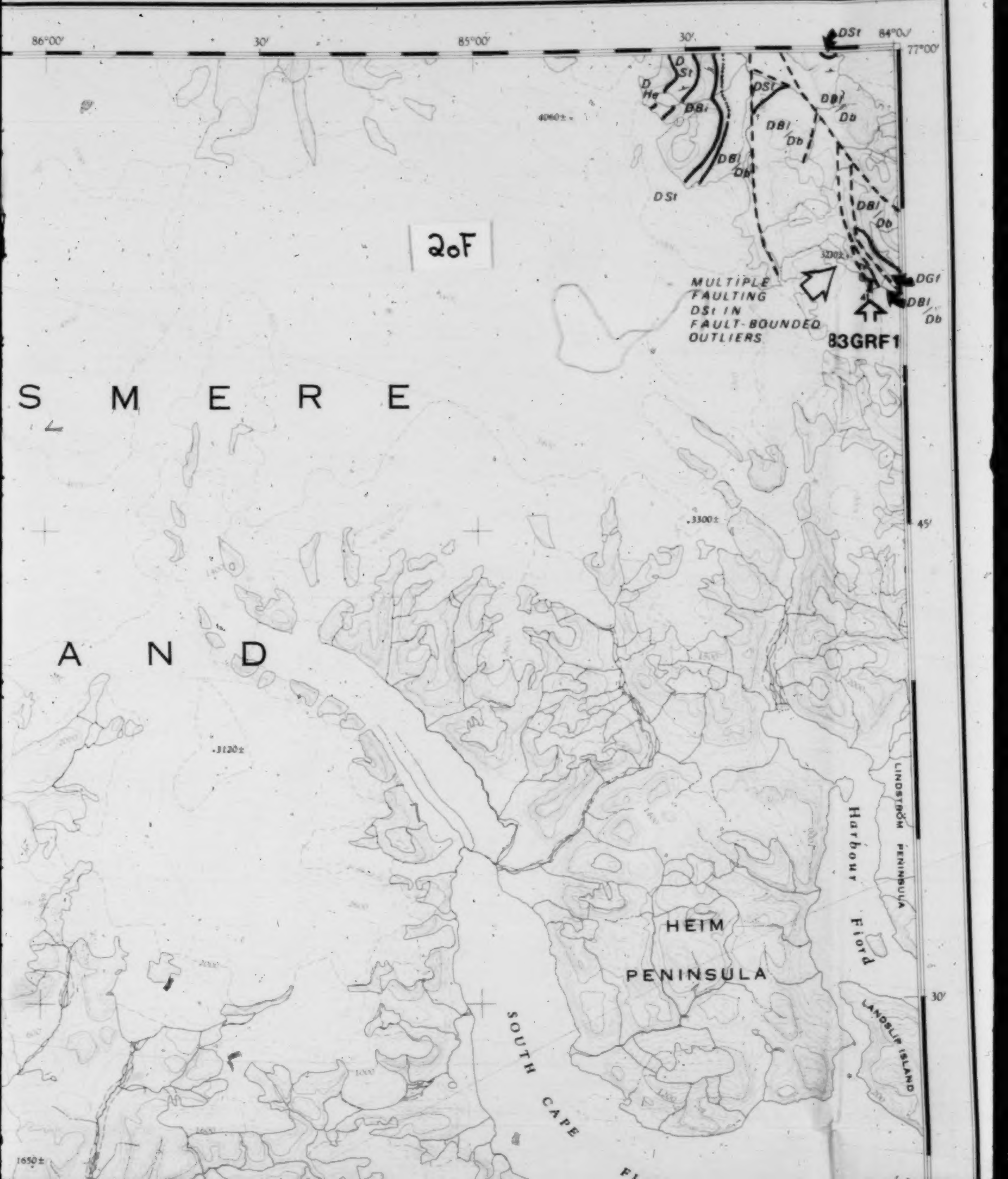
CANA


88°00'
77°00'
30'
87°00'
30'
86°00'
45'
30'
2190±
2495±
2430±
2900±
2430±
2040±
1430±
1810±
E L L E S
I S L A
DHe
DSt
DBi
DB/
Db
DGf
dykes
120
83A
83B
82BSS
1-9
SS10
B1
B2
B3
B4
B
158
131
12
A2
A3
A1
A
132
88
225
172
82A
82B
MUSKOX FIORD
BAAD FIORD

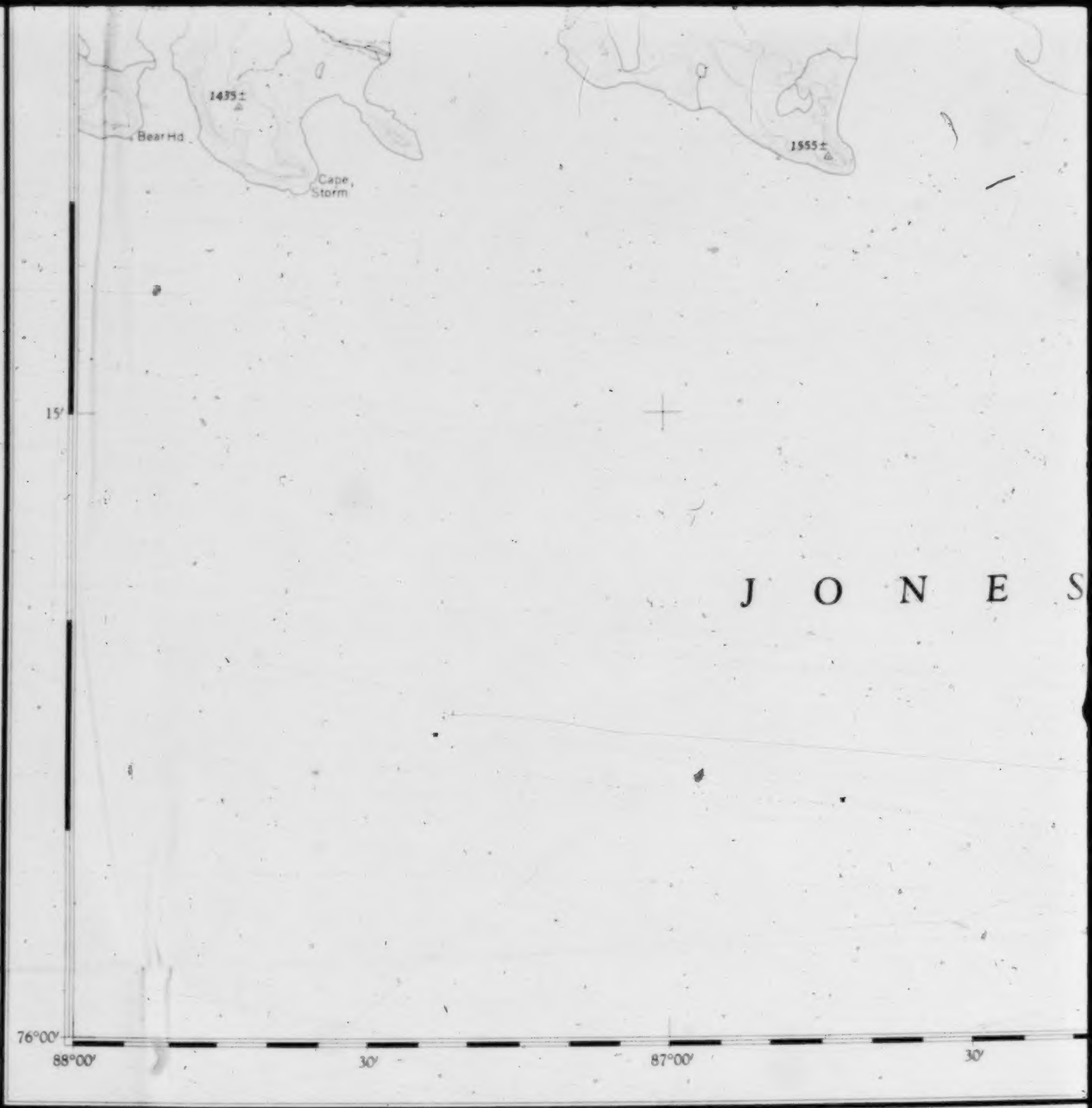
NADA

EDITION 1

49 B


86°00′
30′
85°00′
30′
84°00′
77°00′
DSt
D St
D He
DBl
DSt
DBl Db
DBl Db
DBl Db
DBl Db
DSt
4060±
20F
MULTIPLE FAULTING DSt IN FAULT-BOUNDED OUTLIERS
83GRF1
DGl
DBl Db
3200±
S M E R E
A N D
3300±
45′
3120±
LINDSTRÖM PENINSULA
Harbour Fiord
HEIM PENINSULA
30′
LANDSLIP ISLAND
SOUTH CAPE FI
1650±

30F



RELIABILITY DIAGRAM · CROQUIS D'EXACTITUDE

A Stereo compiled from 1959 aerial photography.

A- Rédigée par stéréorestitution d'après des photographies aériennes prises en 1959.

Produced 1966 by the **SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES.**
Field surveys 1961. Printed 1967.

The daily change of the North Magnetic Pole renders the magnetic compass unreliable in this area. Magnetic declination 1966 varies from 94°56′ westerly at centre of west edge to 90°30′ westerly at centre of east edge.

For complete reference see reverse side.

Copies may be obtained from the Canada Map Office, Department of Energy, Mines and Resources, Ottawa, or your nearest map dealer.

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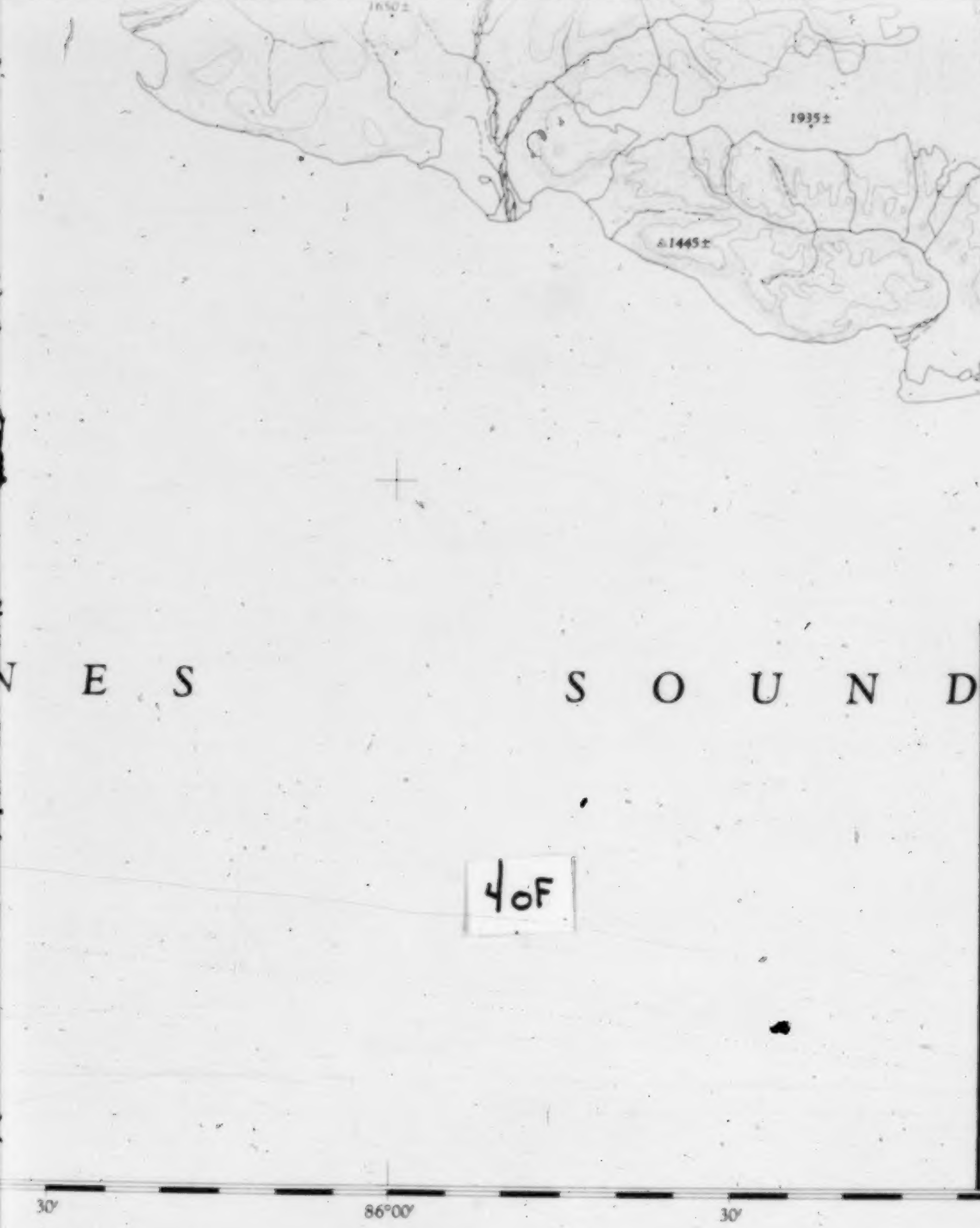
Some names on this map are not yet official. Corrections or additions are invited by the Surveys and Mapping Branch.

Miles 5

Kilometres 5

Transverse Mercator Pr
North American Datu
Contour interval 200
Elevations in feet above Me



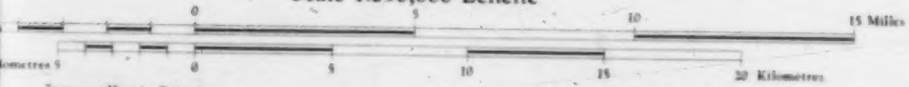
LEGEND

DHe	*Hecla Bay Fm*
DSt	*Strathcona Fiord F*
DBi	*Bird Fiord Fm*
DBl/Db	*Blue Fiord/ Disappo*
DGf	*Goose Fiord Fm*
⇨	*measured section (m*
·SS	*spot locality*
··········	*covered contact*
– – – –	*fault*

et official
ed by the

BAAD FIORD
DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES

Scale 1:250,000 Échelle



Transverse Mercator Projection
North American Datum 1927
Contour interval 200 feet
Elevations in feet above Mean Sea Level

Projection Transverse de Mercator
Niveau de référence nord américain 1927
Équidistance des courbes 200 pieds
Élévations en pieds au dessus du niveau moyen de la mer

Certains noms inscrits sur cette carte ne sont pas encore officiels. La Direction des levés et de la cartographie saurait gré au public de lui signaler corrections et additions.

Établie en 1966, par la **DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES.** Levés sur le terrain en 1961. Imprimée en 1967.

La variation diurne du pôle Nord magnétique rend le compas magnétique peu sûr dans cette région. La déclinaison magnétique pour 1966 varie de 94°56′ Ouest au centre de la limite Ouest à 90°30′ Ouest au centre de la limite Est.

Pour une liste complète de signes voir au verso.

[illegible] en vente au Bureau des Cartes du C
ministère de l'[illegible] Ottawa,
ou chez le vendeur le plus près.

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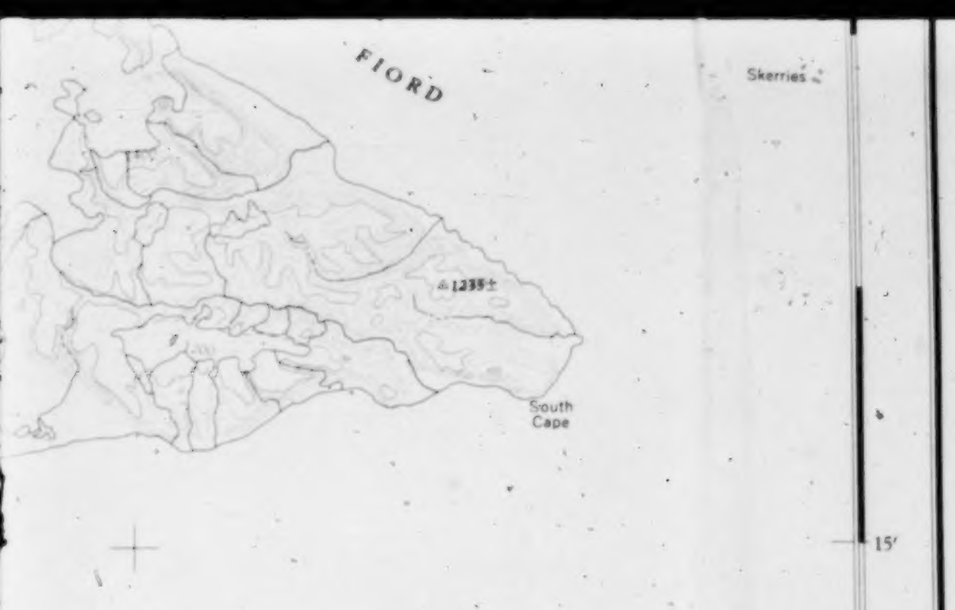
FIORD
Skerries
1235±
South Cape
15′

5of5

LEGEND

DHe	Hecla Bay Fm
DSt	Strathcona Fiord Fm
DBi	Bird Fiord Fm
DBl/Db	Blue Fiord/Disappointment Bay Fm undifferentiated
DGf	Goose Fiord Fm
⇨	measured section (meters)
·SS	spot locality
·········	covered contact
- - - - -	fault

76°00′
85°00′ 30′ 84°00′

Établie en 1966, par la **DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES.** Levés sur le terrain en 1961. Imprimée en 1967.

La variation diurne du pôle Nord magnétique rend le compas magnétique peu sûr dans cette région. La déclinaison magnétique pour 1966 varie de 94°56′ Ouest au centre de la limite Ouest à 90°30′ Ouest au centre de la limite Est.

Pour une liste complète de signes voir au verso.

[illegible] ent en vente au Bureau des Cartes du [illegible] ministère de l'Énerg[illegible] ources, Ottawa, ou chez le vendeur le plus près.

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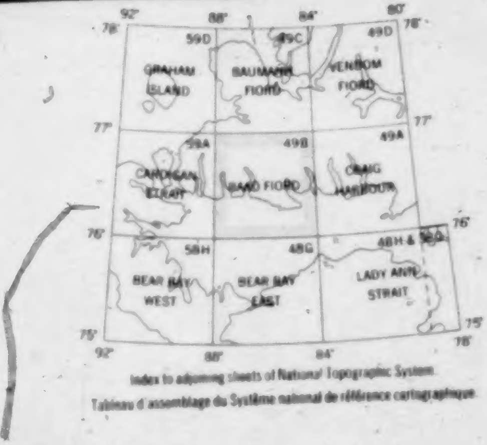

92°
88°
84°
80°
78°
77°
76°
75°
59D
49C
49D
GRAHAM ISLAND
BAUMANN FIORD
VENDOM FIORD
59A
49B
49A
CARDIGAN STRAIT
BAAD FIORD
CRAIG HARBOUR
58H
48G
48H & 38E
BEAR BAY WEST
BEAR BAY EAST
LADY ANN STRAIT

Index to adjoining sheets of National Topographic System.
Tableau d'assemblage du Système national de référence cartographique.

BAAD FIORD
49 B
EDITION 1

1oF

LEGEND

CENOZOIC

QUATERNARY

Q	*Stream, deltaic, glacial, and marine beach sediments (mapped only where underlying bedrock geology could not be inferred with reasonable certainty)*

MESOZOIC

CRETACEOUS (AND POSSIBLY TERTIARY)

KTi	*IGNEOUS ROCKS: andesite; dykes and plugs; includes one flow that is interbedded with the Eureka Sound Formation at the head of Freemans Cove*
KTe	*EUREKA SOUND FORMATION: sandstone, shale, coal, interbedded lava flow*

JURASSIC

Jj	*JAEGER FORMATION: sandstone, quartzose*

TRIASSIC

TRh	*HEIBERG FORMATION: quartz sandstone, minor ferruginous sandstone and coal*
TRs	*SCHEI POINT FORMATION: calcareous sandstone, bioclastic limestone*
TRb	*BJORNE FORMATION: quartz sandstone, crossbedded*

PERMIAN

Ptf	*TROLD FIORD FORMATION: sandstone, glauconitic, minor chert*
Pbc	*BELCHER CHANNEL FORMATION: limestone, dolomitic, porous to vuggy; minor chert*

DEVONIAN

MIDDLE AND UPPER DEVONIAN

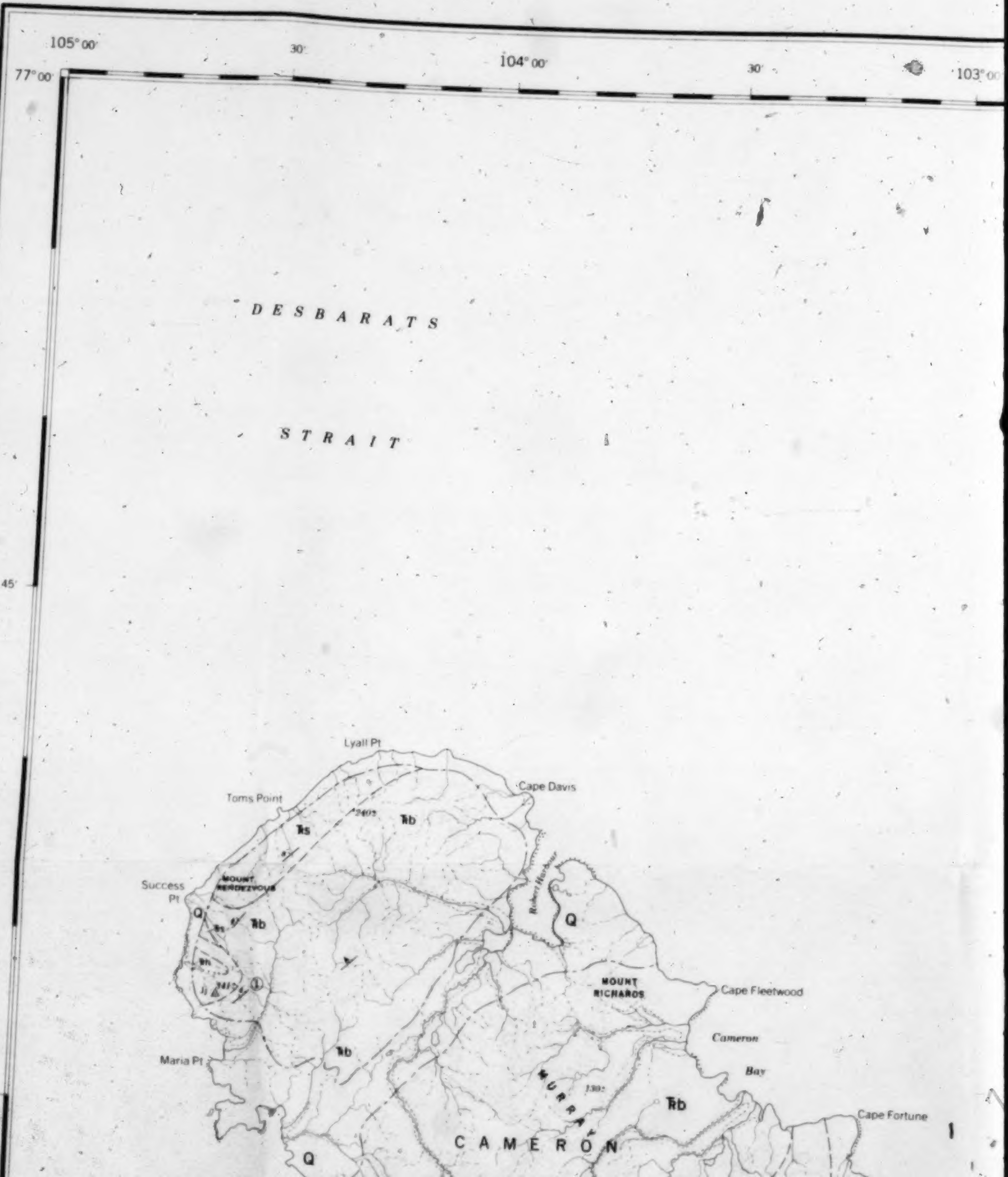
MELVILLE ISLAND GROUP

Dmg	*GRIPER BAY FORMATION: quartz sandstone, siltstone, shale, commonly greenish weathering*

MIDDLE AND UPPER DEVONIAN

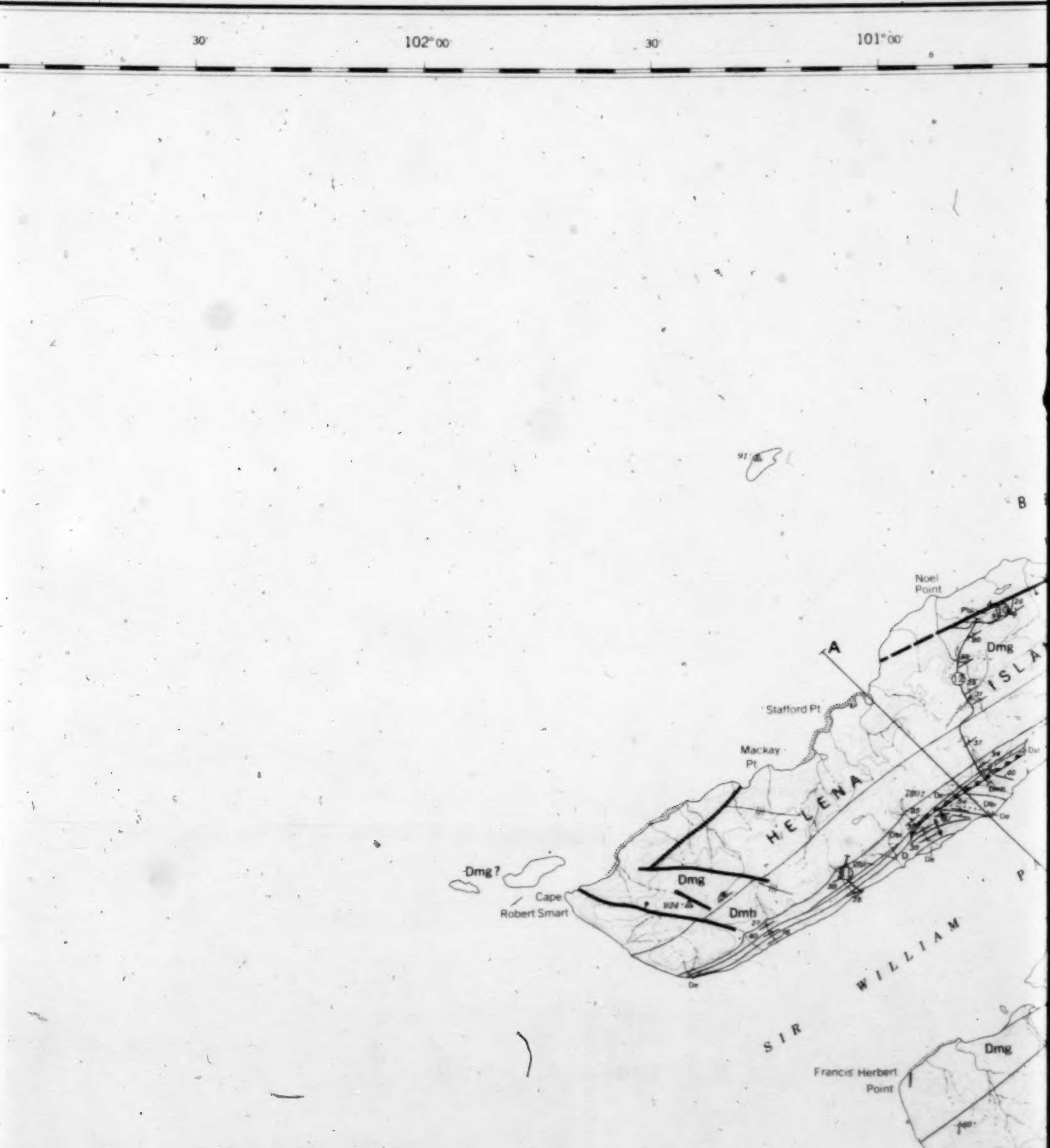
Dmh	*HECLA BAY FORMATION: quartz sandstone, resistant to recessive*

20F


105° 00'
30'
104° 00'
30'
103° 00'
77° 00'
45'
30'
DESBARATS
STRAIT
Lyall Pt
Toms Point
Cape Davis
2405
TRs
TRb
Robert Harbour
Success Pt
MOUNT RENDEZVOUS
Q
Q
MOUNT RICHARDS
Cape Fleetwood
Cameron
Bay
Maria Pt
MURRAY
1301
Cape Fortune
CAMERON
1

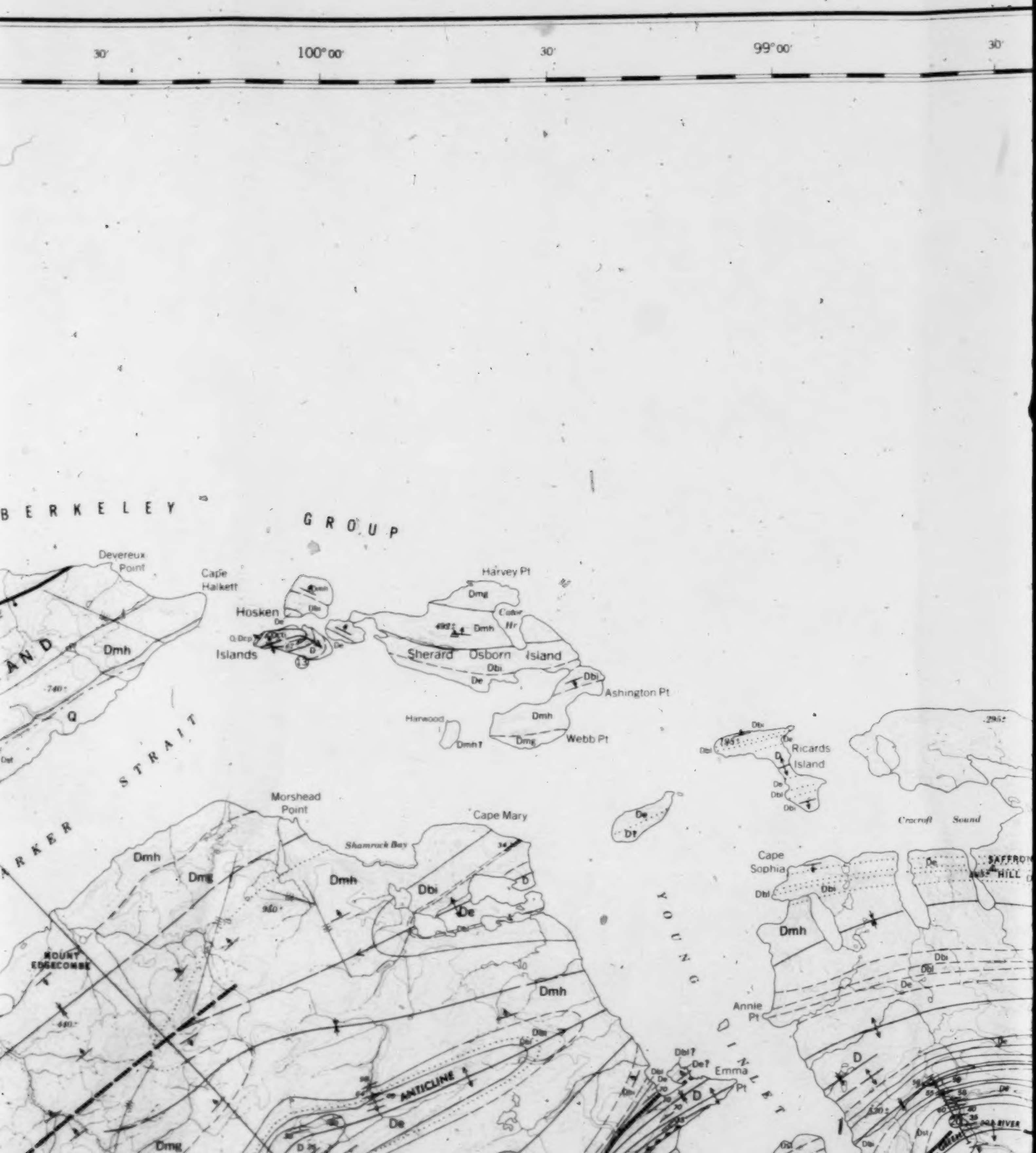
30F

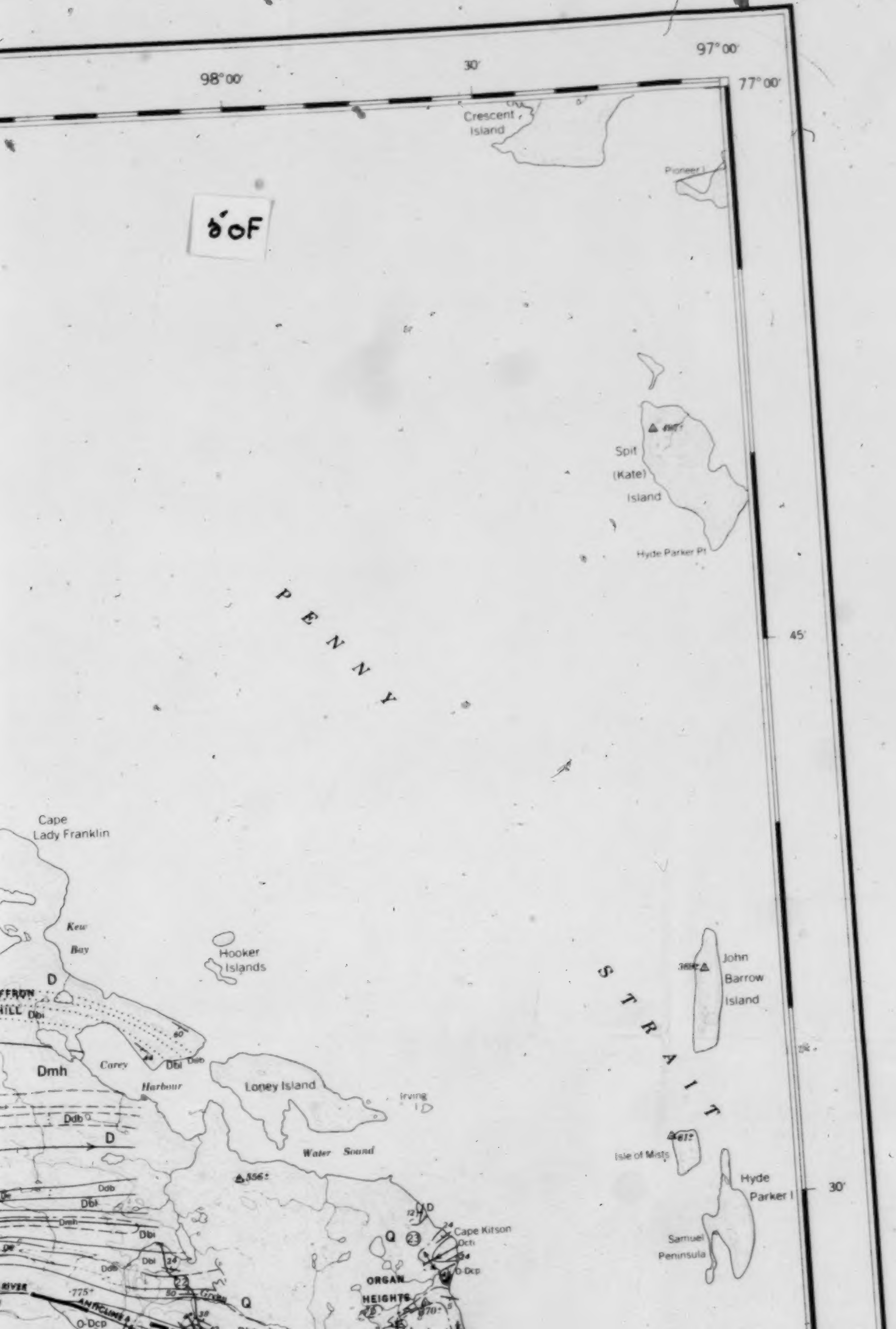
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES


30'
102°00'
30'
101°00'
91
B
Noel Point
A
Dmg
ISLA
Stafford Pt
Mackay Pt
HELENA
Dmg?
Dmg
Cape Robert Smart
Dmh
Ds
De
D
P
SIR WILLIAM
Dmg
Francis Herbert Point

4 oF

DA
RCES


30'
100°00'
30'
99°00'
30'
BERKELEY
GROUP
Devereux Point
Cape Halkett
Hosken Islands
Harvey Pt
Sherard Osborn Island
Ashington Pt
Harwood
Webb Pt
Ricards Island
Cracroft Sound
SAFFRON HILL
Cape Sophia
Morshead Point
Cape Mary
Shamrock Bay
STRAIT
PARKER
YOUNG INLET
Annie Pt
Emma Pt
MOUNT EDGECOMBE
ANTICLINE
Dmh
Dmg
Dbi
De
D
Dt
Q
Dmh?
Dbl?
De?
740±
980±
440±
620±
295±
195±
492±


97°00′
30′
98°00′
77°00′
Crescent Island
Pioneer I
8′0F
Spit (Kate) Island
Hyde Parker Pt
PENNY
45′
STRAIT
Cape Lady Franklin
Kew Bay
Hooker Islands
D
John Barrow Island
Dmh
Carey Harbour
Dbi
Ddb
Loney Island
Irving I
Water Sound
556
Isle of Mists
Hyde Parker I
30′
Samuel Peninsula
Cape Kitson
Q
ORGAN HEIGHTS
O-Dcp
ANTICLINE
RIVER

6 oF

PALEOZOIC

MIDDLE AND UPPER DEVONIAN

Dmh	*HECLA BAY FORMATION* quartz sandstone, resistant to recessive

MIDDLE DEVONIAN

Dbi	*BIRD FIORD FORMATION* limestone, quartz sandstone, siltstone, commonly greenish

LOWER AND MIDDLE DEVONIAN

Dbl	*BLUE FIORD FORMATION* limestone, micritic in south and east, biostromal to the north and west
De	*EIDS FORMATION* limestone, siltstone, shale, fissile, recessive in north and west; resistant in east and south

LOWER AND MIDDLE DEVONIAN

Ddb	*DISAPPOINTMENT BAY FORMATION* dolomite, porous to vuggy, resistant, light cream

LOWER DEVONIAN

Dst	*STUART BAY FORMATION* siltstone, shale, limy, minor conglomerate and limestone interbeds, in south and east limestone is abundant
Dba	*BATHURST ISLAND FORMATION* siltstone, fine-grained sandstone, dolomite, minor limestone
D	*BATHURST ISLAND AND STUART BAY FORMATIONS (undivided)*

ORDOVICIAN TO DEVONIAN

UPPER ORDOVICIAN TO LOWER DEVONIAN

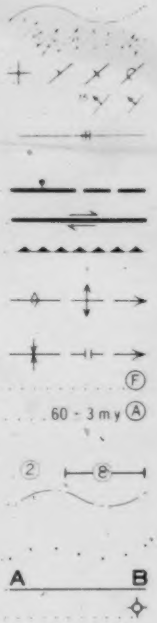
O-Dcp	*CAPE PHILLIPS FORMATION* siltstone, shale, argillaceous limestone; graptolitic, minor dolomite

ORDOVICIAN

MIDDLE AND UPPER ORDOVICIAN

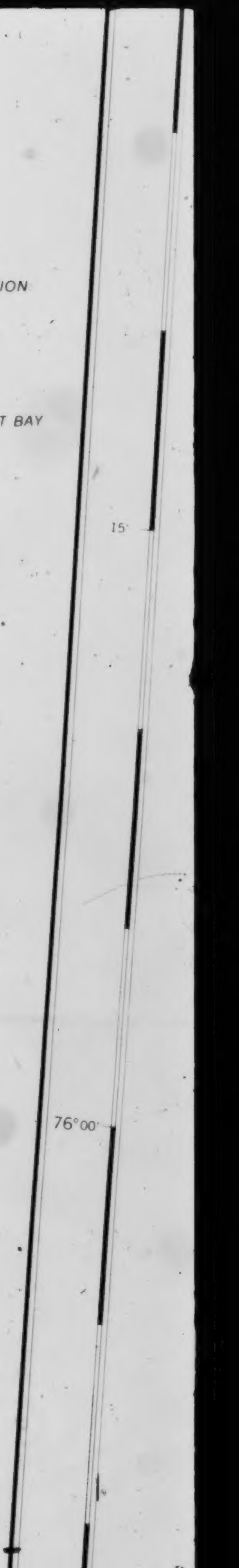
Octi	CORNWALLIS GROUP *IRENE BAY FORMATION* limestone, thin-bedded, green limy shale interbeds, recessive *THUMB MOUNTAIN FORMATION* limestone, thick-bedded bluff-forming, minor dolomite
Ocb	*BAY FIORD FORMATION* anhydrite and anhydritic shale, caprock of limestone and limy dolomite

Geological boundary (defined, approximate, assumed)
Line of facies change
Bedding (horizontal, inclined, vertical, overturned)
Bedding observed from aircraft (estimated dip direction only)
Lineament (fault or fracture; from air photographs)
Normal fault (defined, approximate; solid circle indicates downthrow side)
Strike-slip fault (defined, arrows indicate direction of movement)
Thrust fault (defined; teeth indicate upthrust side)
Anticline (defined, approximate; showing culmination, and plunge of axis)
Syncline (defined, approximate; showing culmination, and plunge of axis)
Fossil locality
Locality where age has been determined radiometrically
Measured section (showing section number and location or line of traverse)
Boundary of Quaternary sediments
Geological boundary, fold axis, or fault, inferred beneath water, glacier, or Quaternary sediments
Line of section
Abandoned well

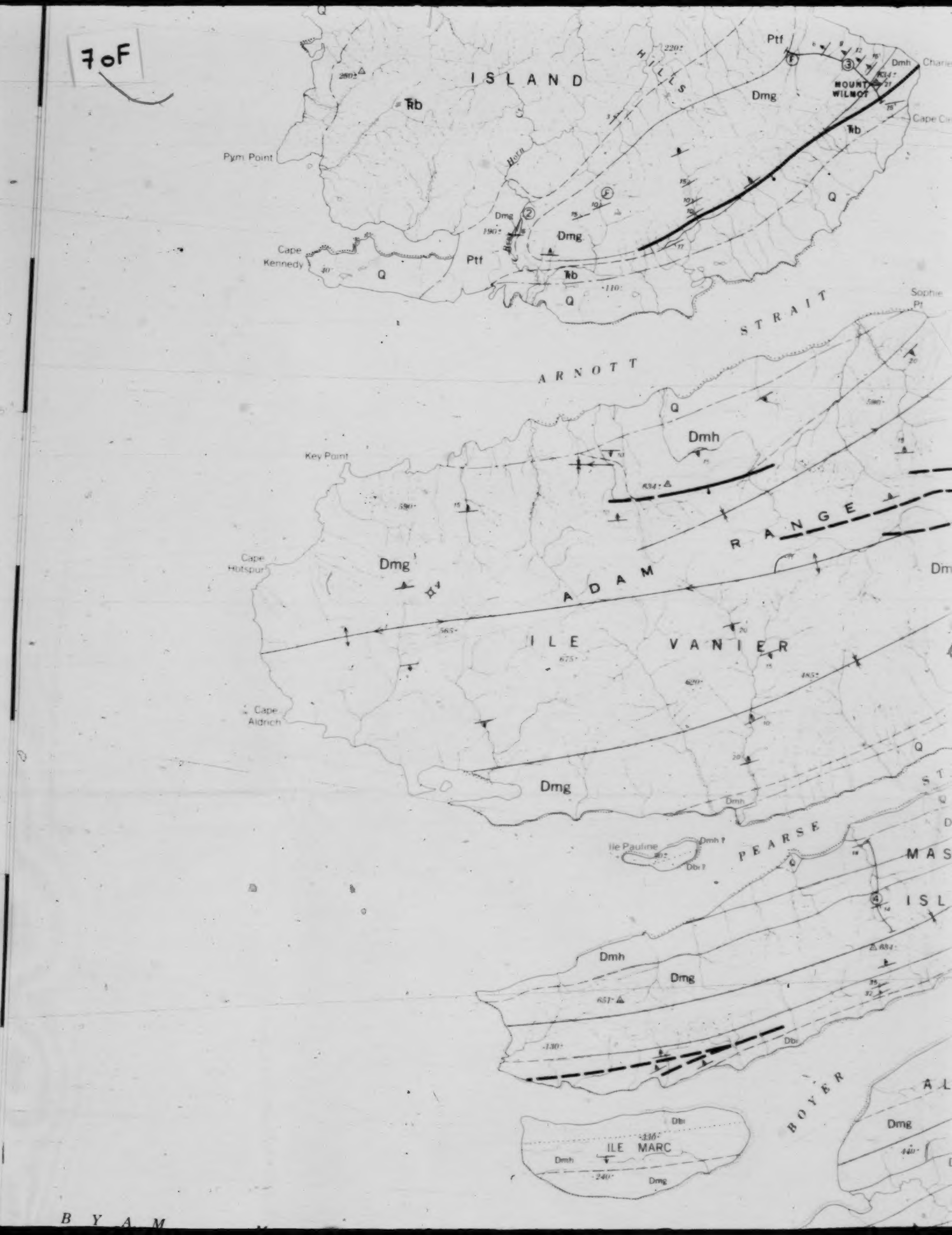


INDEX TO WELLS

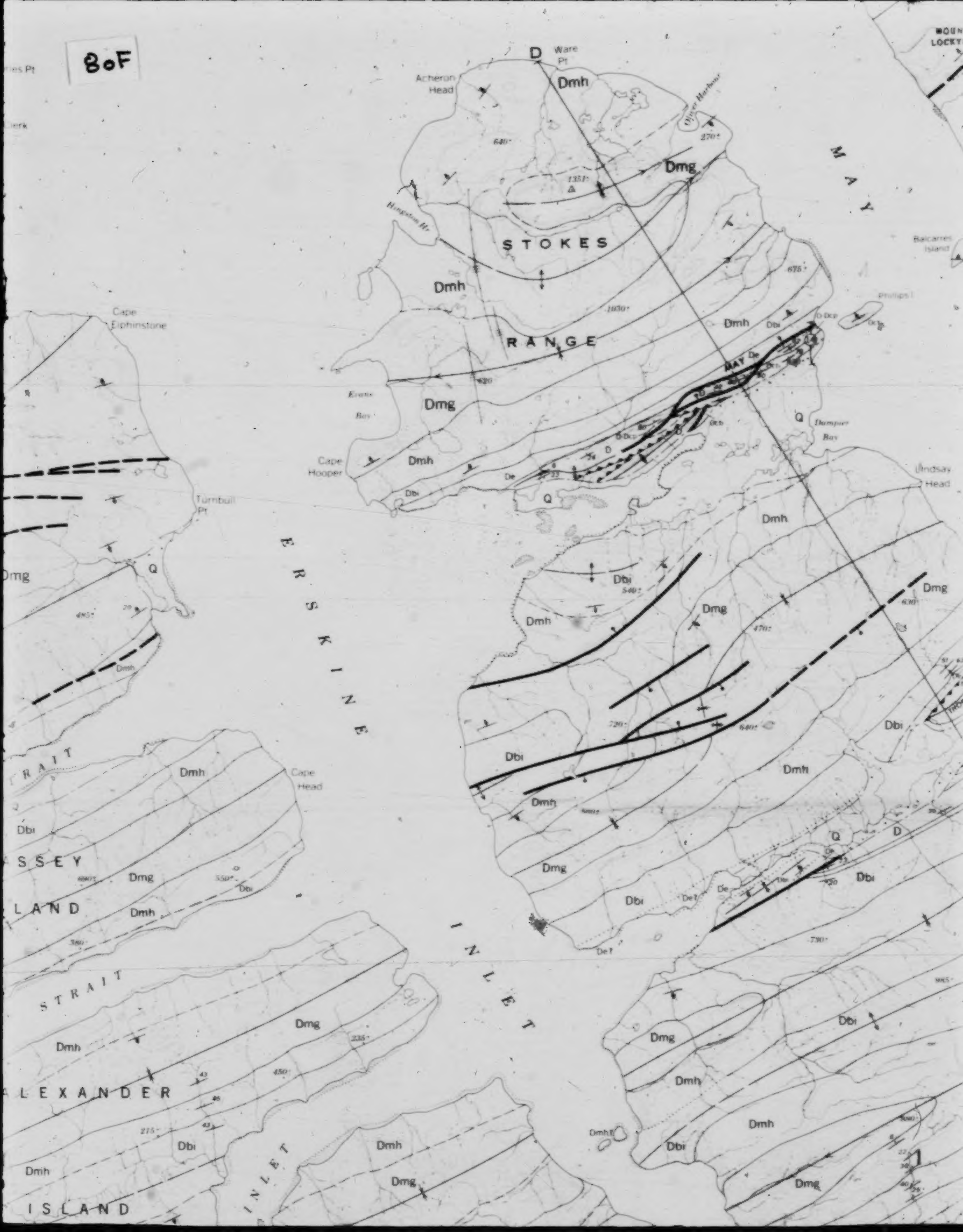
Dominion Explorers et al., Bathurst Caledonian R. J-34	1
Sun KR Panarctic Allison R. N-12	2
Sun KR Panarctic Young Inlet D-21	3
BP et al., Panarctic Hotspur J-20	4

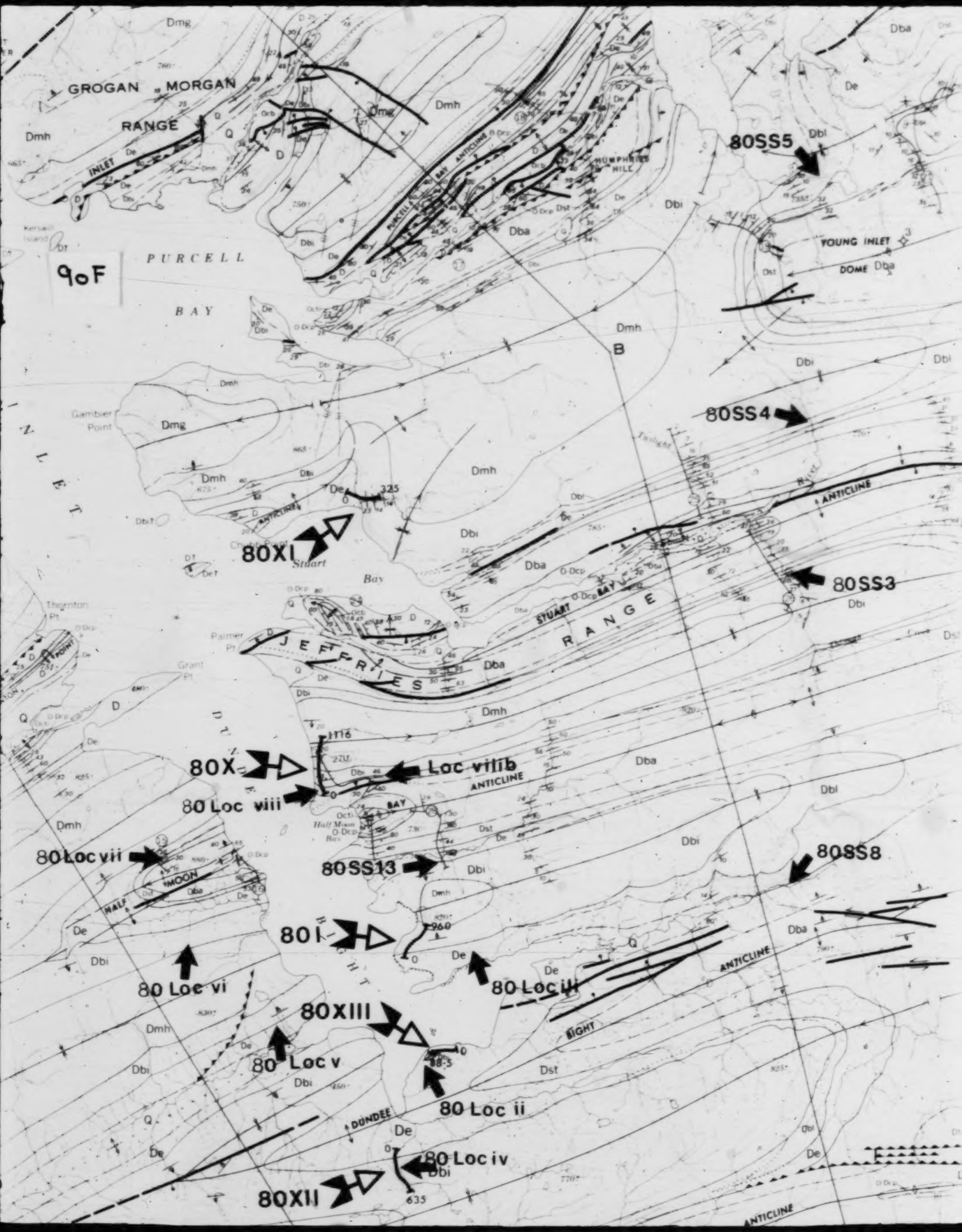


7oF

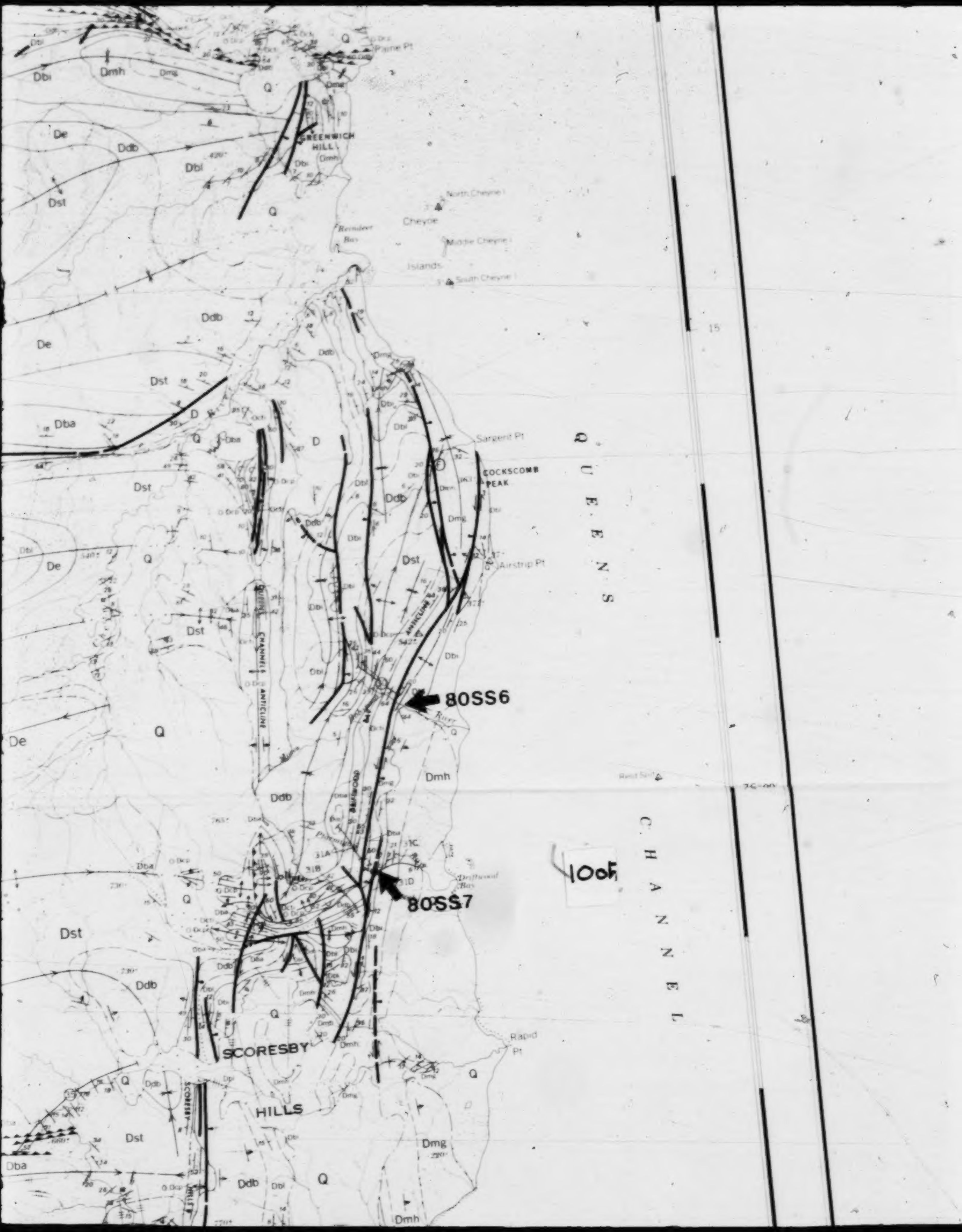

Q
ISLAND
HILLS
Ptf
Dmh
Charles
MOUNT WILMOT
Dmg
Cape Cr
Ŧb
Pym Point
Horn
Q
Dmg
190±
Cape Kennedy
Ptf
Q
Ŧb
Q
110±
220±
280±
Sophie Pt
STRAIT
ARNOTT
Q
Dmh
Key Point
634±
590±
Cape Hotspur
Dmg
RANGE
ADAM
Dm
ILE VANIER
565±
675±
620±
485±
Cape Aldrich
Q
Dmg
Dmh
ST
Ile Pauline
Dmh ?
Dbi ?
PEARSE
MAS
ISL
684±
Dmh
Dmg
651±
130±
Dbi
BOYER
AL
Dmg
440±
Dbi
330±
ILE MARC
Dmh
240±
Dmg
BYAM

80F


D
Ware Pt
Acheron Head
Oliver Harbour
Dmh
640'
270'
Dmg
1351'
Hingston Hr
STOKES
RANGE
Dmh
1030'
675'
MAY
Balcarres Island
Phillips I
Cape Elphinstone
Dmh
Dbi
MAY
620
Evans Bay
Dmg
Q
Dampier Bay
Cape Hooper
Dmh
Dbi
De
D
Q
Turnbull Pt
Lindsay Head
Dmh
Dmg
Q
485'
ERSKINE INLET
Dbi
540'
Dmh
Dmg
470'
Dmg
630'
Dmh
720'
640'
Dbi
Dbi
Dmh
Dmh
680'
STRAIT
Dmh
Cape Head
Dbi
SSEY
Dmg
550'
Dbi
LAND
Dmh
Dmg
Q
D
Dbi
Dbi
De
De?
380'
790'
STRAIT
Dmg
235'
965'
Dmh
Dbi
Dmg
ALEXANDER
450'
Dmh
215'
Dbi
Dmh
Dmh
Dmh
Dbi
INLET
Dmg
Dmg
ISLAND
MOUNT LOCKYER



9oF
GROGAN
MORGAN
RANGE
INLET
PURCELL
BAY
PURCELL BAY ANTICLINE
HUMPHRIES HILL
80SS5
YOUNG INLET
DOME
B
80SS4
Twilight
River
ANTICLINE
80XI
Stuart
Bay
80SS3
STUART BAY
RANGE
JEFFRIES
INLET
Gambier Point
Thornton Pt
Palmer Pt
Grant Pt
Kerswill Island
DUNDEE
BIGHT
80X
Loc viiib
ANTICLINE
80 Loc viii
Half Moon Bay
80Loc vii
HALF MOON
80SS13
80SS8
80I
80 Loc iii
ANTICLINE
BIGHT
80 Loc vi
80XIII
80 Loc v
80 Loc ii
DUNDEE
80 Loc iv
80XII
ANTICLINE
Dmg
Dmh
Dbi
Dba
De
Dst
Dbl
D
Q
O Dcp
Ocb


Paine Pt
GREENWICH HILL
North Cheyne I
Cheyne Islands
Middle Cheyne I
South Cheyne I
Reindeer Bay
Sargent Pt
COCKSCOMB PEAK
Airstrip Pt
QUEENS CHANNEL
ANTICLINE
CHANNELS ANTICLINE
80SS6
80SS7
100F
Driftwood Bay
Rapid Pt
SCORESBY HILLS
15
Dbi
Dmh
Dmg
De
Ddb
Dst
Dba
Q
D

et al. Panarctic Hotspur J-20

11oF

Geology by J. Wm. Kerr, 1963, 1964

To accompany GSC Memoir 378, by J. Wm. Kerr

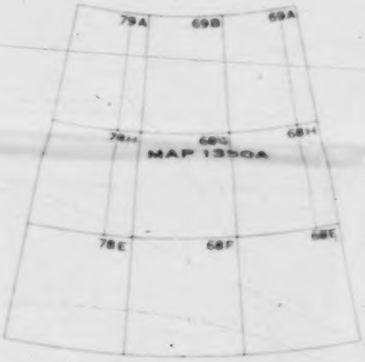
Geological cartography by the Institute of Sedimentary and Petroleum Geology, 1972

Any revisions or additional geological information known to the user
would be welcomed by the Geological Survey of Canada

Horizontal control point	△
Intermittent stream	
Foreshore, tidal flats	
Contours (interval 100 feet)	
Raised beaches, sand	
Height in feet above mean sea-level	730'

Base-map cartography by the Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada, 1972, from maps published at 1/250,000 scale (McDougall Sound, Graham Moore Bay, Penny Strait, Helena Island and parts of Domett Point, Byam Channel, Lowther Island) by the Army Survey Establishment, R.C.E., in 1965, 1966

The daily change of the North Magnetic Pole causes the
magnetic compass to be very erratic in this area



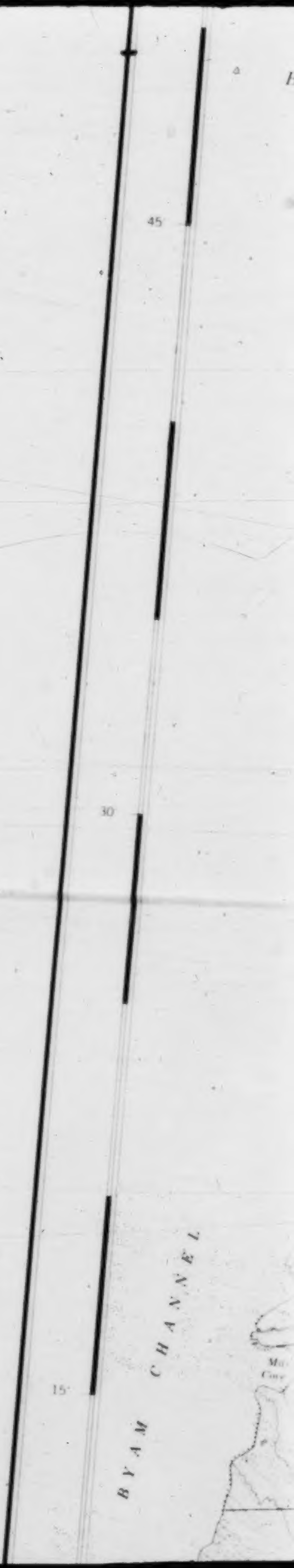
NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX
TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

INDEX MAP

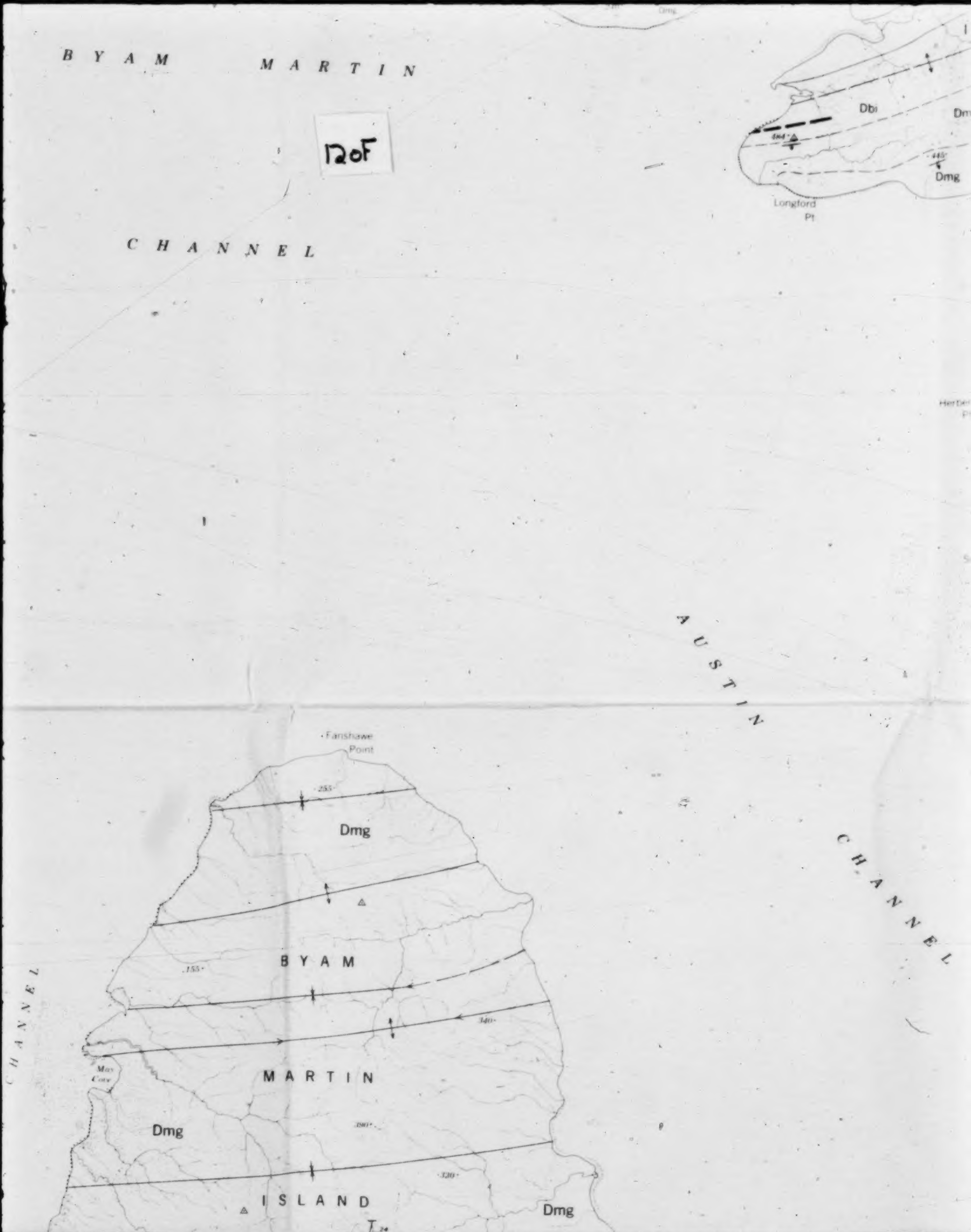
MAP 1350A

GEOLOGY

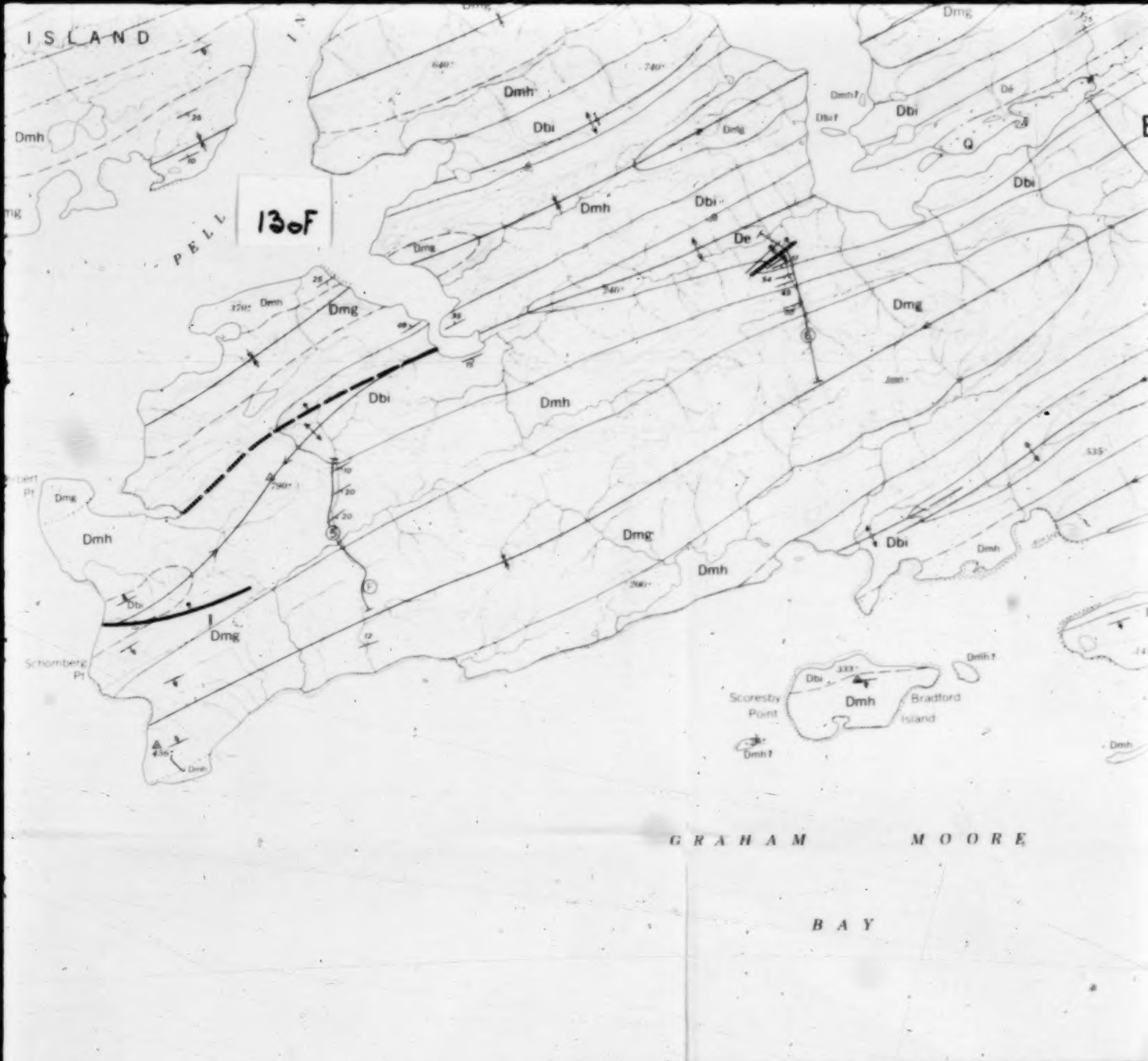
BATHURST ISLAND GROUP



12oF


BYAM MARTIN CHANNEL
Dbi
Dm
484
445
Dmg
Longford Pt
Herbe
AUSTIN CHANNEL
Fanshawe Point
255
Dmg
BYAM
155
340
MARTIN
May Cove
Dmg
180
320
ISLAND
Dmg
CHANNEL
24

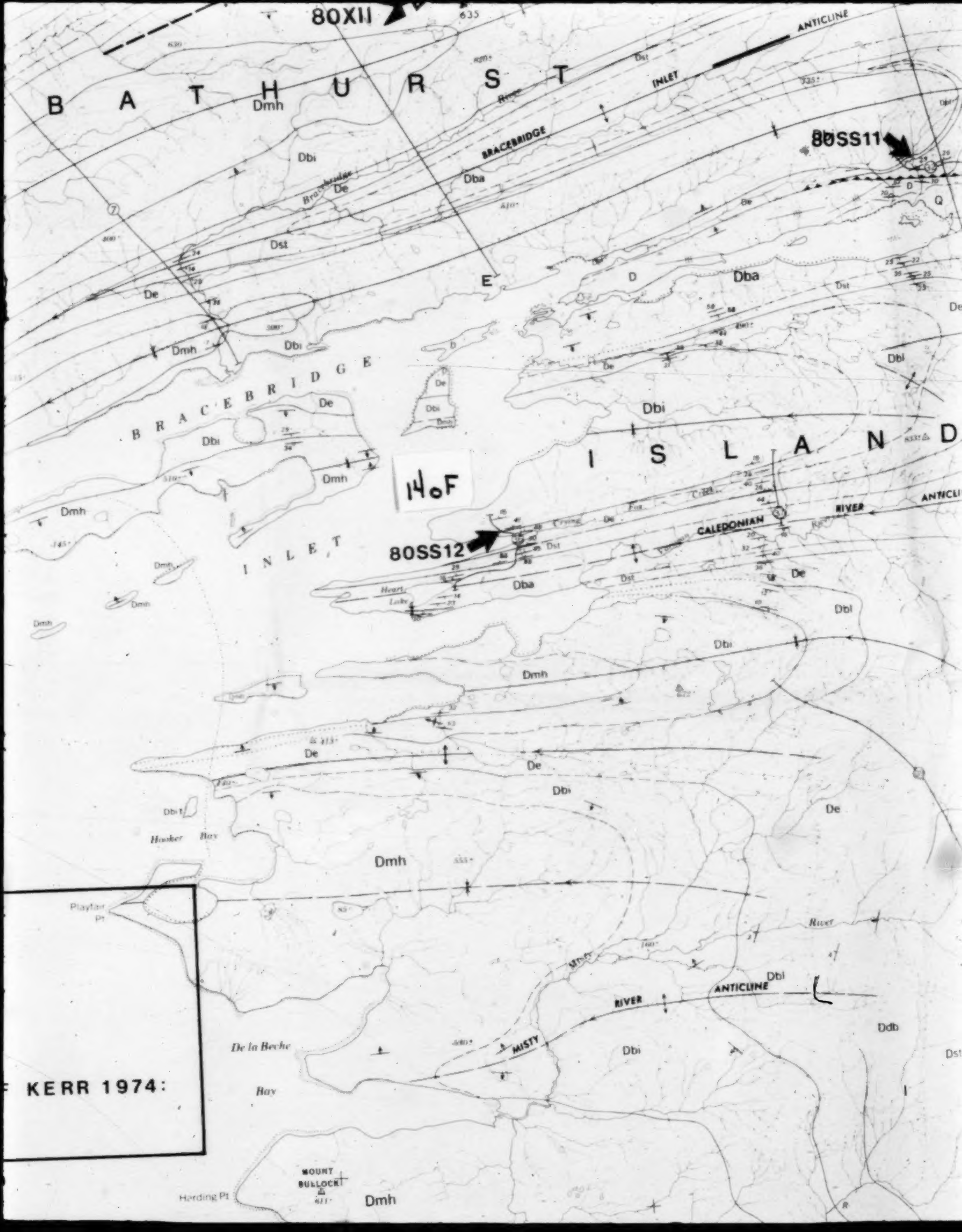
13oF


ISLAND
PELL
Dmg
Dmh
Dbi
Dmg
Dmh?
Dbi?
Dbi
De
Q
Dbi
Dmh
Dbi
De
Dmg
Dmg
Dmh
Dmg
Dbi
Dmh
Dmg
Dmh
Dbi
Dmg
Dmh
Dbi
Dmh
Dmg
Schomberg Pt
Dmh
Dbi
Dmh
Scoresby Point
Bradford Island
Dmh?
Dmh?
Dmh
GRAHAM MOORE
BAY

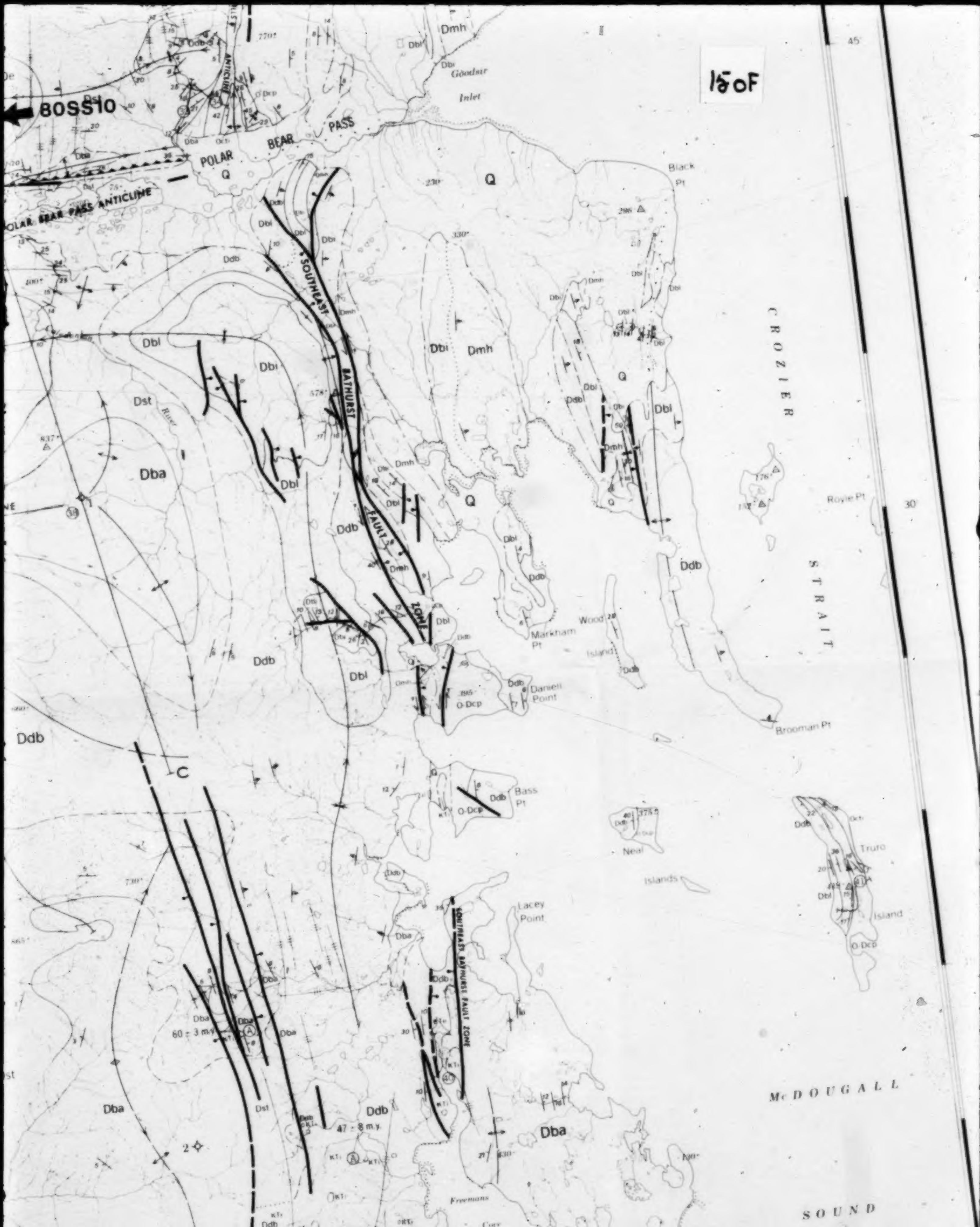
MEASURED SECTION (meters)

SPOT LOCALITY

GEOLOGICAL NOMENCLATURE OF KER
SEE TEXT FOR REVISIONS

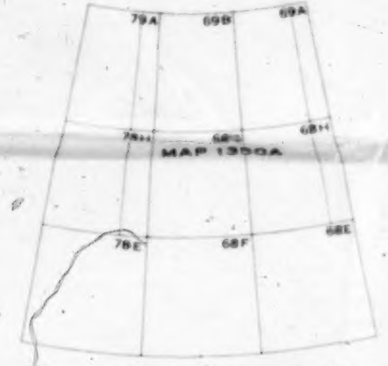

80XII
635
ANTICLINE
B A T H U R S T
Dmh
Dst
INLET
BRACEBRIDGE
Dbi
Bracebridge
De
Dba
80SS11
D
Q
Dst
E
D
Dba
Dst
De
Dmh
Dbi
Dbl
BRACEBRIDGE
De
Dbi
Dbi
Dmh
Dbi
I S L A N D
14oF
Dmh
80SS12
Dst
Crying Fox Creek
CALEDONIAN
RIVER
ANTICLINE
INLET
Heart Lake
Dba
Dst
De
Dbl
Dmh
Dbi
Dmh
De
De
Dbi
Dbi
Hooker Bay
De
Dmh
Playfair Pt
River
Dbl
ANTICLINE
RIVER
MISTY
Ddb
De la Beche Bay
Dbi
Dst
KERR 1974:
MOUNT BULLOCK
Harding Pt
Dmh

15OF


80SS10
POLAR BEAR PASS
POLAR BEAR PASS ANTICLINE
ANTICLINE
Goodsir Inlet
Black Pt
SOUTHEAST BATHURST FAULT ZONE
CROZIER STRAIT
Royle Pt
Markham Pt
Wood Island
Daniell Point
Brooman Pt
Bass Pt
Neal Islands
Truro Island
Lacey Point
SOUTHEAST BATHURST FAULT ZONE
McDOUGALL SOUND
Freemans Cove
River
Q
Dmh
Dbl
Ddb
Dba
Dst
O-Dcp
Dbi
Ocb
KT1
C
60 ± 3 m.y.
47 ± 8 m.y.
45
30
770
230
330
296
378
837
176
152
195
175
730
865
330
100

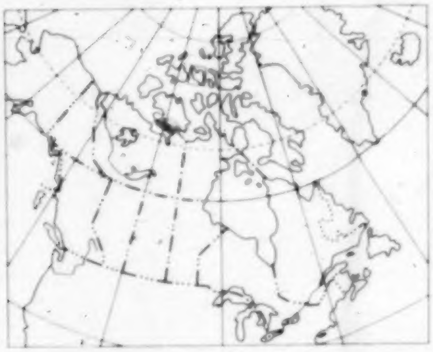
The daily change of the North Magnetic Pole causes the magnetic compass to be very erratic in this area

160F



79A
69B
69A
78H
68G
68H
MAP 1350A
78E
68F
68E

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS



INDEX MAP

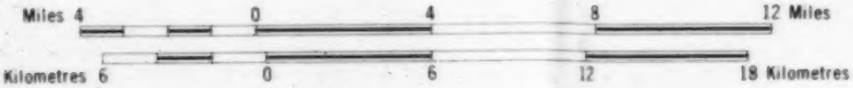
MAP 1350A

GEOLOGY

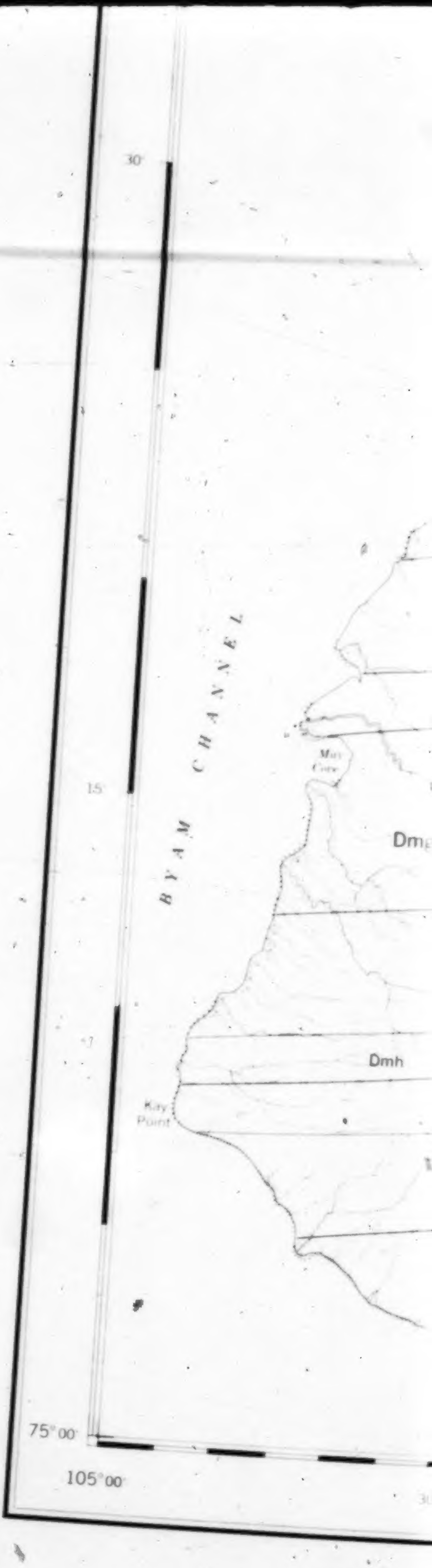
BATHURST ISLAND GROUP AND BYAM MARTIN ISLAND

DISTRICT OF FRANKLIN

Scale 1:250,000

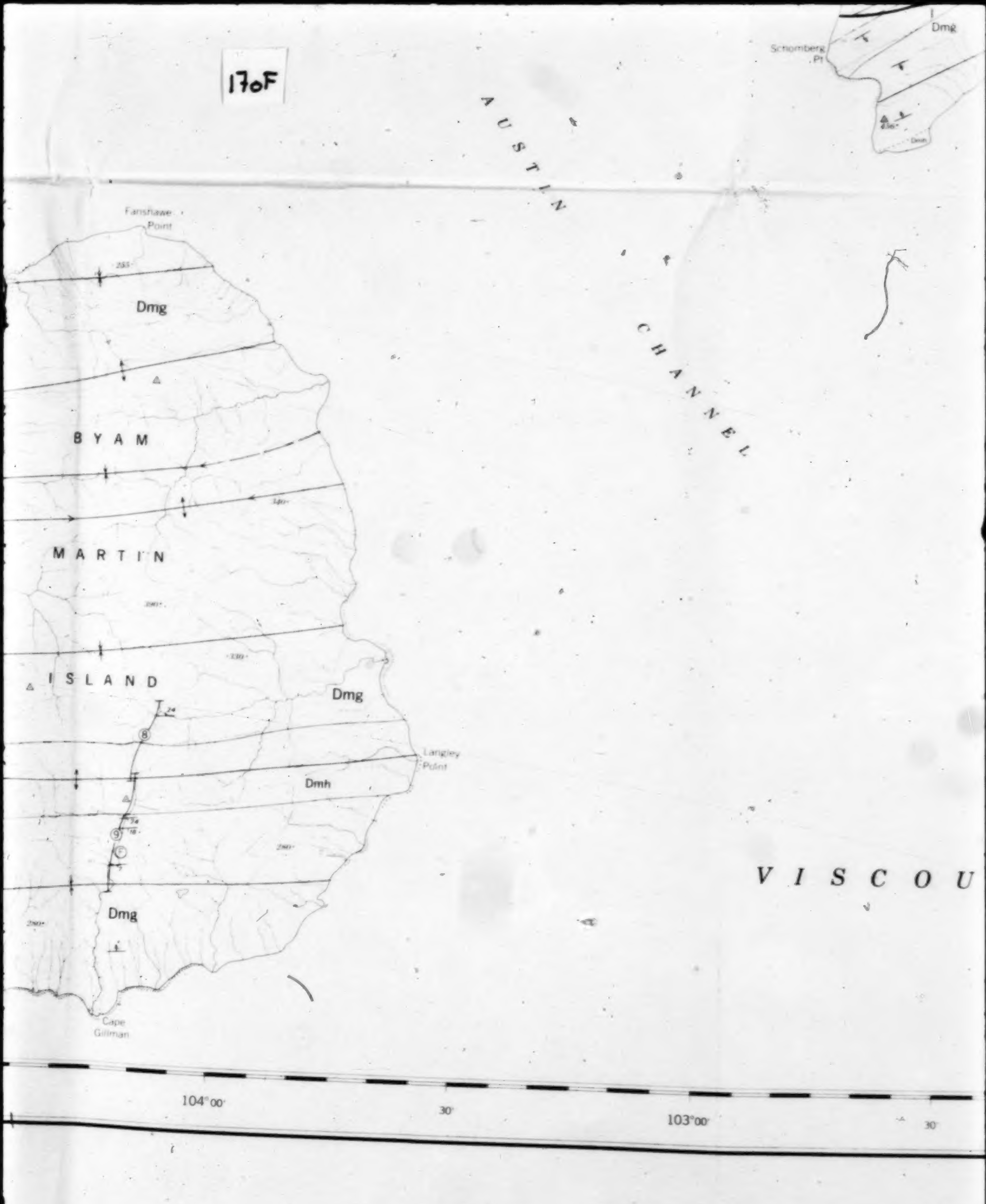


Miles 4
0
4
8
12 Miles
Kilometres 6
0
6
12
18 Kilometres



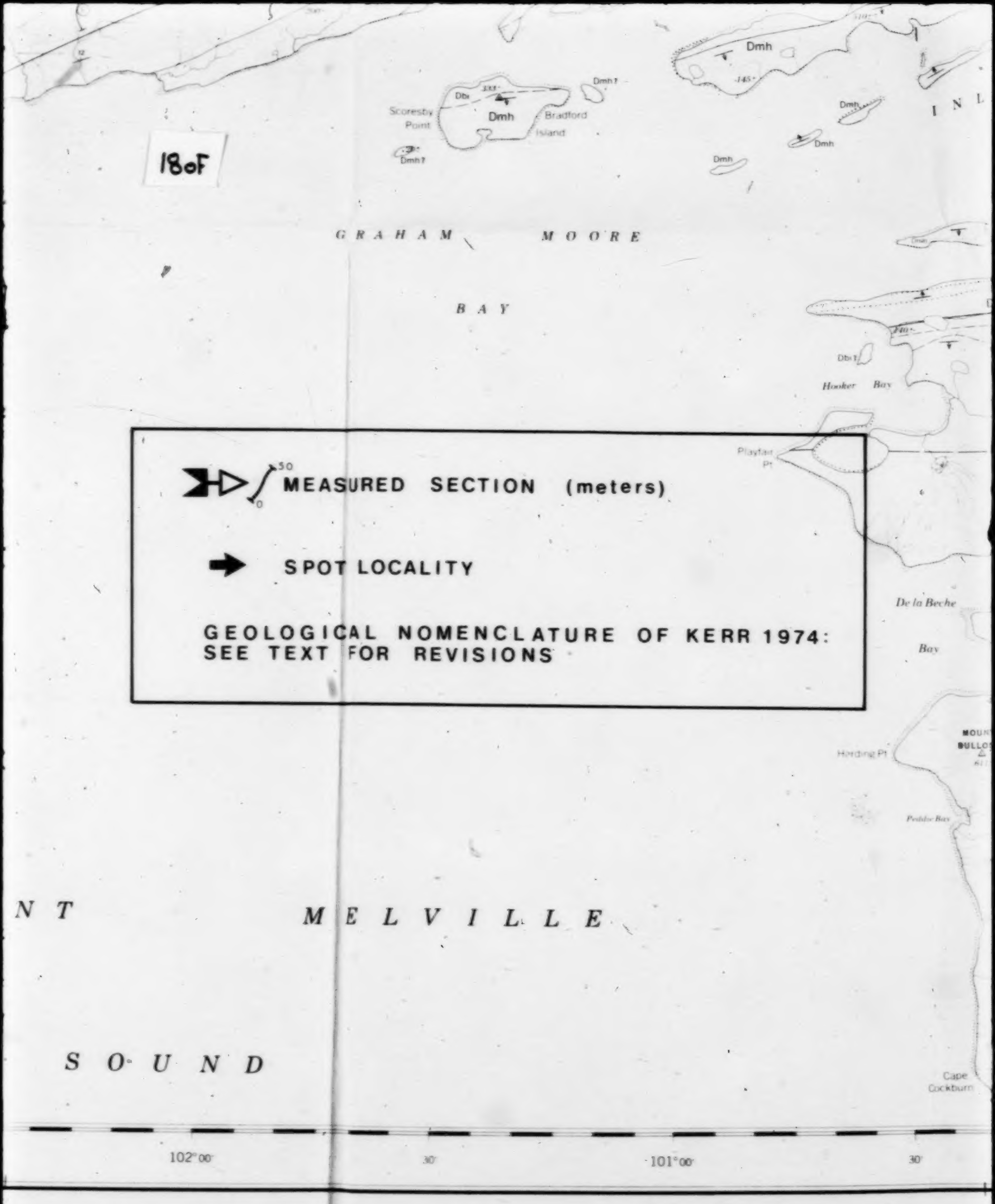
30'
15'
BYAM CHANNEL
Mai Cove
Dmg
Dmh
Kay Point
75°00'
105°00'

170F

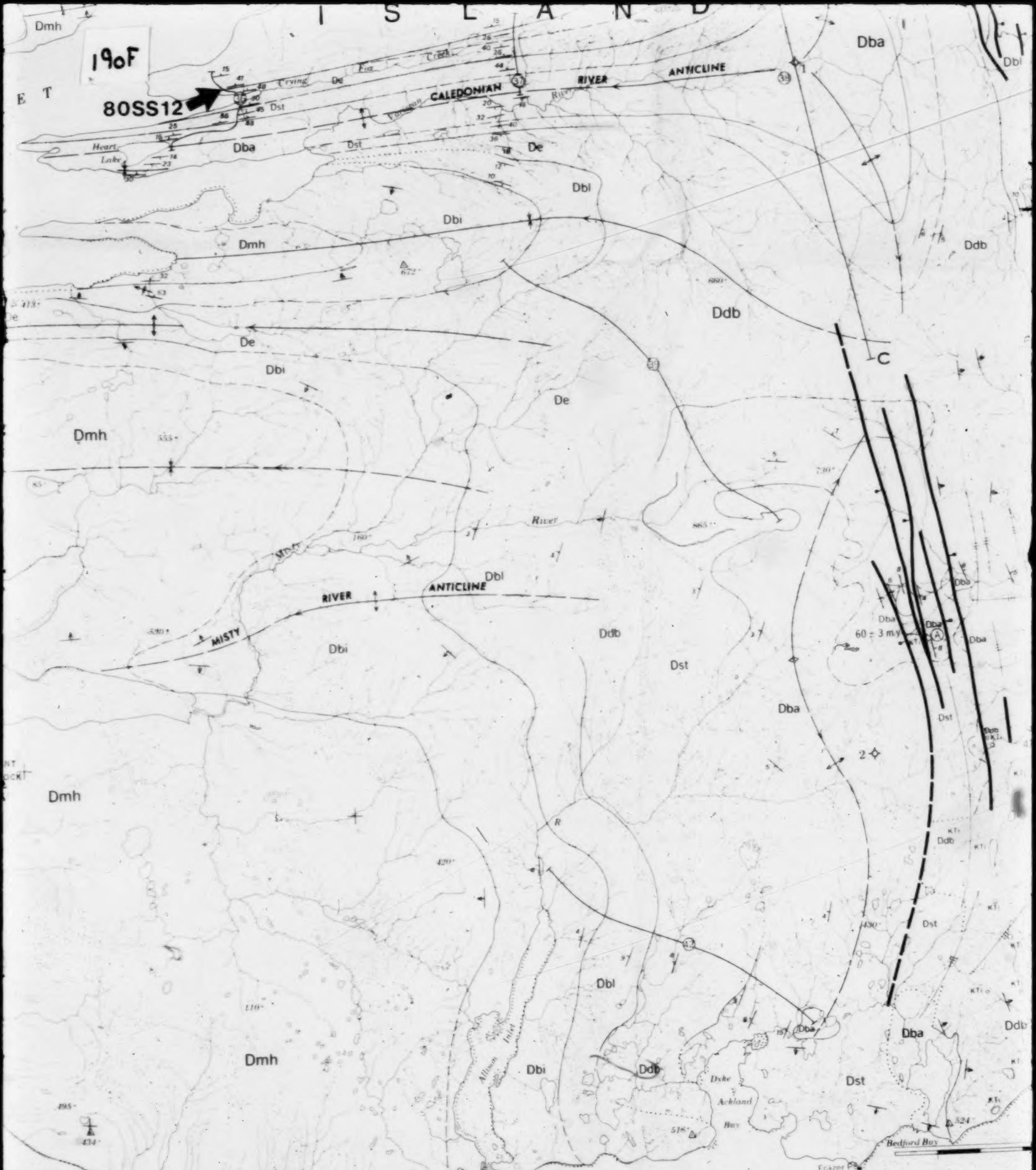


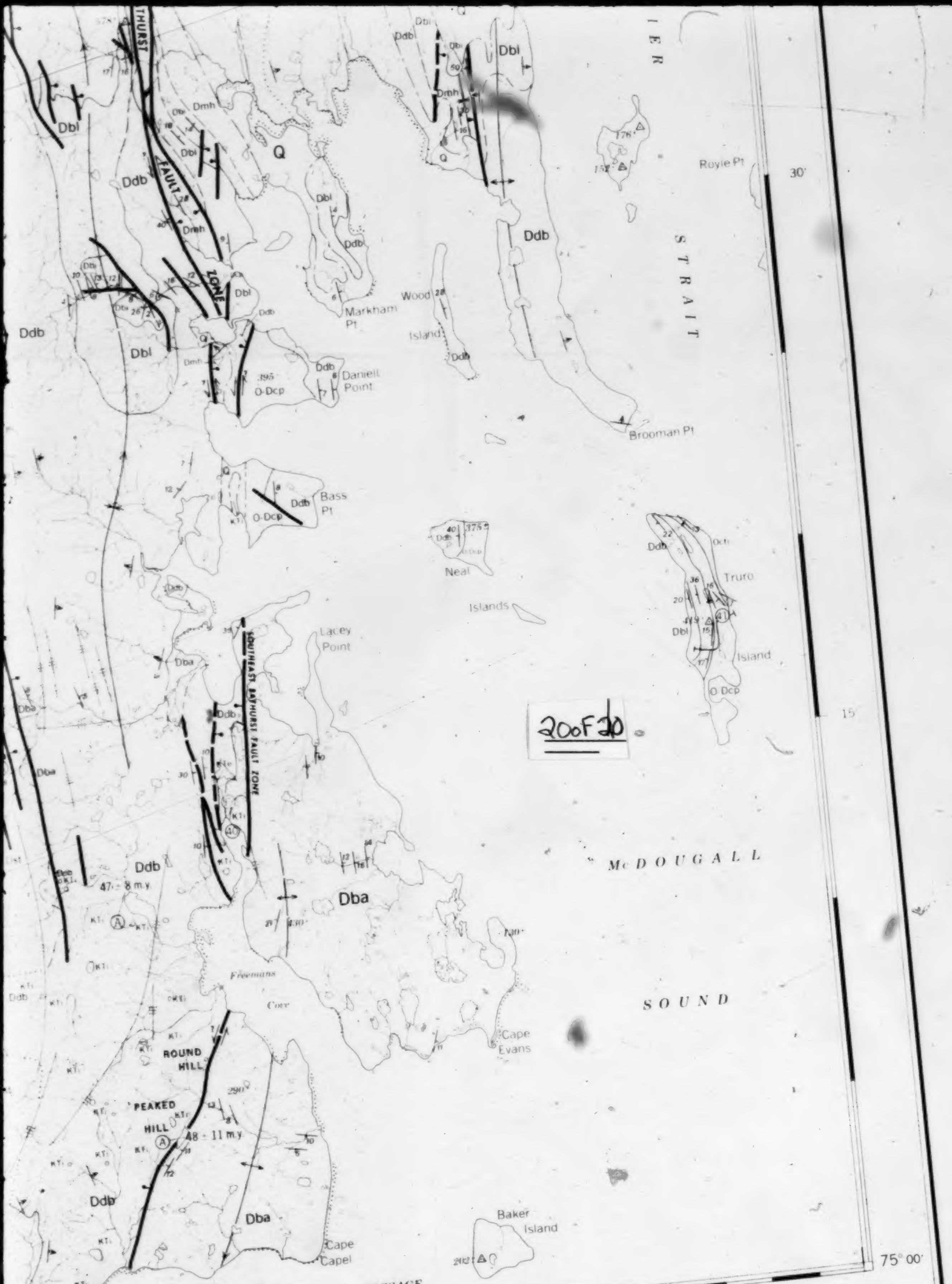
Dmg
Schomberg Pt
AUSTIN CHANNEL
Fanshawe Point
Dmg
BYAM MARTIN ISLAND
340'
280'
330'
Dmg
8
Langley Point
Dmh
9
280'
Dmg
280'
Cape Gillman
VISCOU
104°00'
30'
103°00'
30'

18oF


Dmh
Dbi
Scoresby Point
Dmh
Bradford Island
Dmh ?
Dmh ?
Dmh
Dmh
Dmh
145
I N L
G R A H A M M O O R E B A Y
Dbi ?
Hooker Bay
Playfair Pt
De la Beche Bay
Harding Pt
Pebble Bay
Cape Cockburn
N T
M E L V I L L E
S O U N D
50
0
MEASURED SECTION (meters)
SPOT LOCALITY
102°00'
30'
101°00'
30'

GEOLOGICAL NOMENCLATURE OF KERR 1974: SEE TEXT FOR REVISIONS

190F
80SS12
I S L A N D
E T
Dmh
Crying
Fox
Creek
CALEDONIAN
RIVER
ANTICLINE
Dst
Dba
De
Heart
Lake
Dbl
Dbi
Dmh
Ddb
De
C
Dbi
Dmh
De
River
Dbl
MISTY
RIVER
ANTICLINE
Dbi
Ddb
Dst
Dba
60 ± 3 m.y.
2
Dmh
R
Dbl
Dbi
Ddb
Allison
Inlet
Dyke
Ackland
Bay
Dba
Dst
Bedford Bay
Frazer Pt
30'


THRUST
FAULT
ZONE
SOUTHEAST BATHURST FAULT ZONE
Dbl
Ddb
Dmh
Q
O-Dcp
Dba
KTi
Markham Pt
Wood Island
Daniell Point
Bass Pt
Neal Islands
Truro Island
Lacey Point
Royle Pt
Brooman Pt
...IER STRAIT
McDOUGALL SOUND
Freemans Cove
Cape Evans
ROUND HILL
PEAKED HILL
47 ± 8 m.y.
48 ± 11 m.y.
Baker Island
Cape Capel
INTREPID PASSAGE
30'
15'
75° 00'
97° 00'
98° 00'
30'
30'

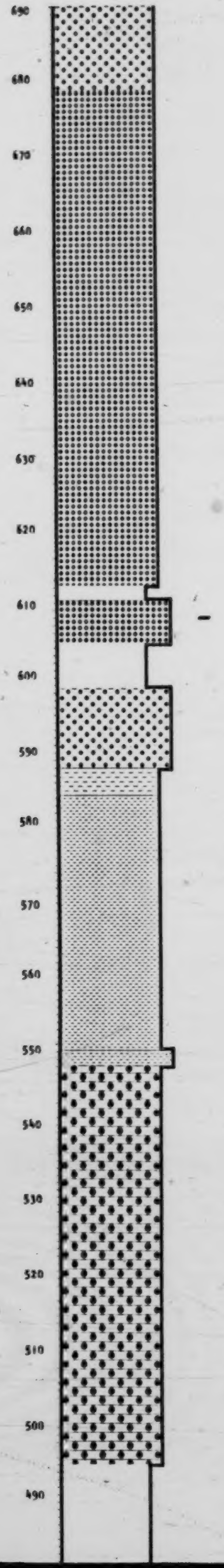
200F20

Printed by the Surveys and Mapping Branch, 1973

1oF

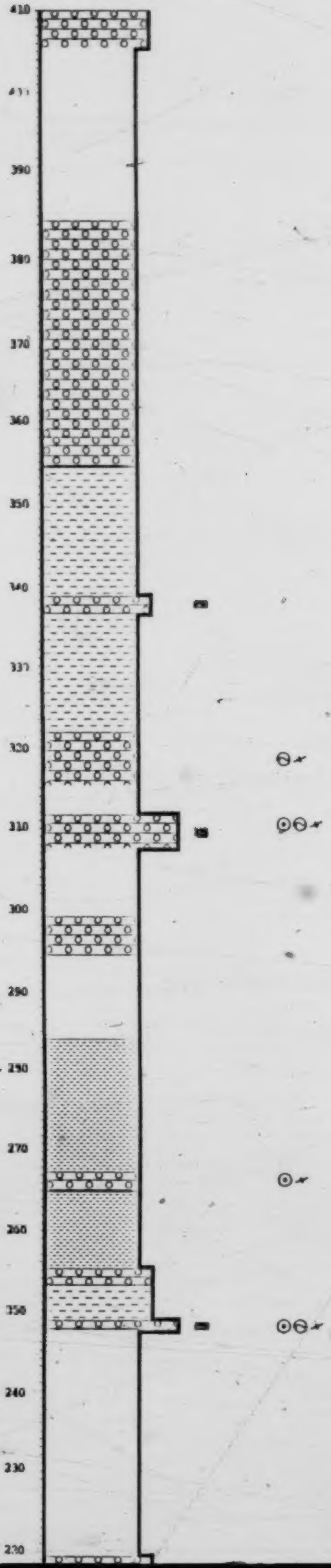
ECTION 81A ENSORCELLEMENT RIVER, GRINNELL PENINSULA

76 49 00 N 94 54 00 W


690
680
670
660
650
640
630
620
610
600
590
580
570
560
550
540
530
520
510
500
490

ENSORCELLEMENT RIVER, GRINNELL PENINSULA, DEVON ISLAND

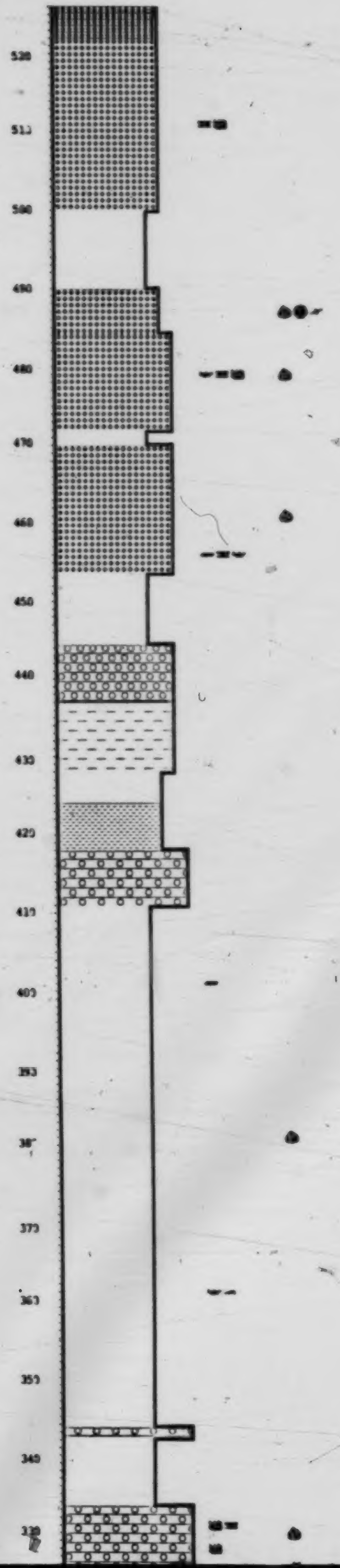
76 49 30 N 94 36 00 N


410
400
390
380
370
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220

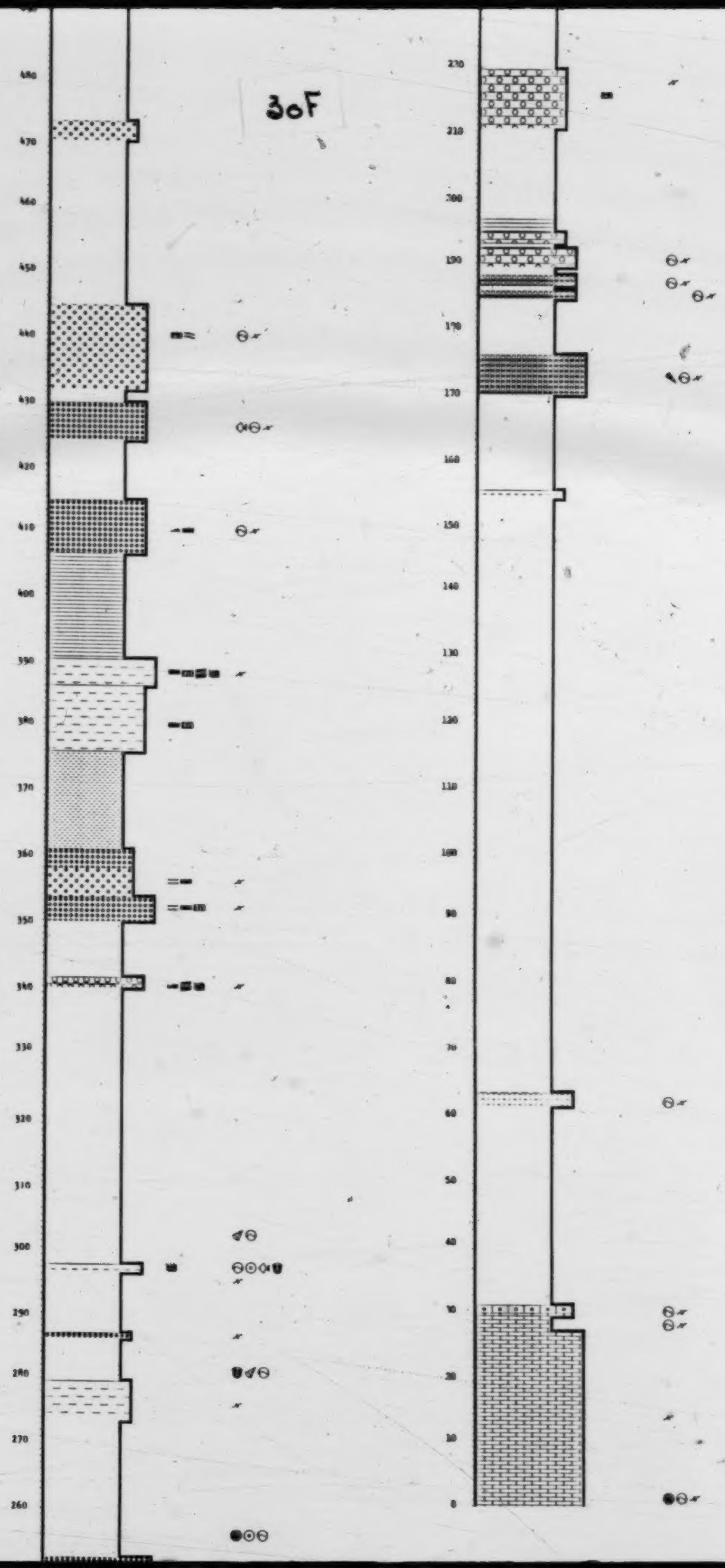
1961 D, TUCKER POINT GRINNELL PENINSULA DEVON ISLAND.

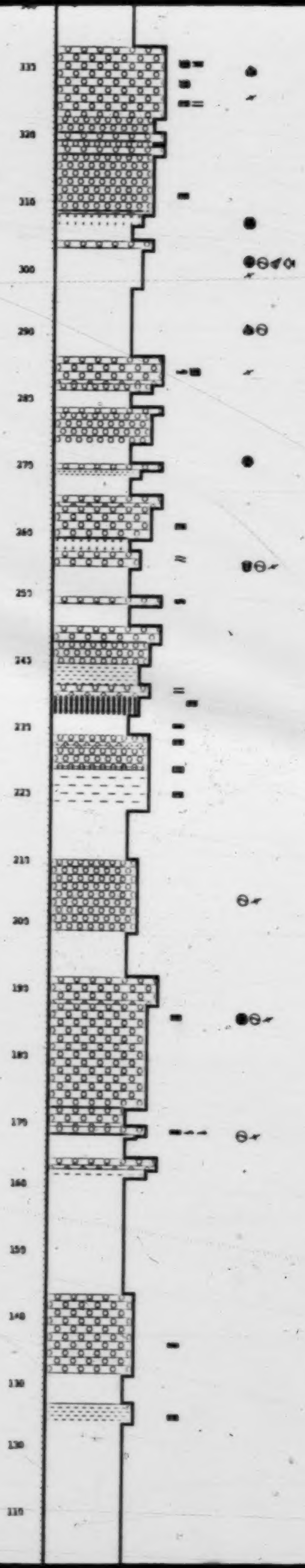
76 41 00 N 93 42 00 W

2oF



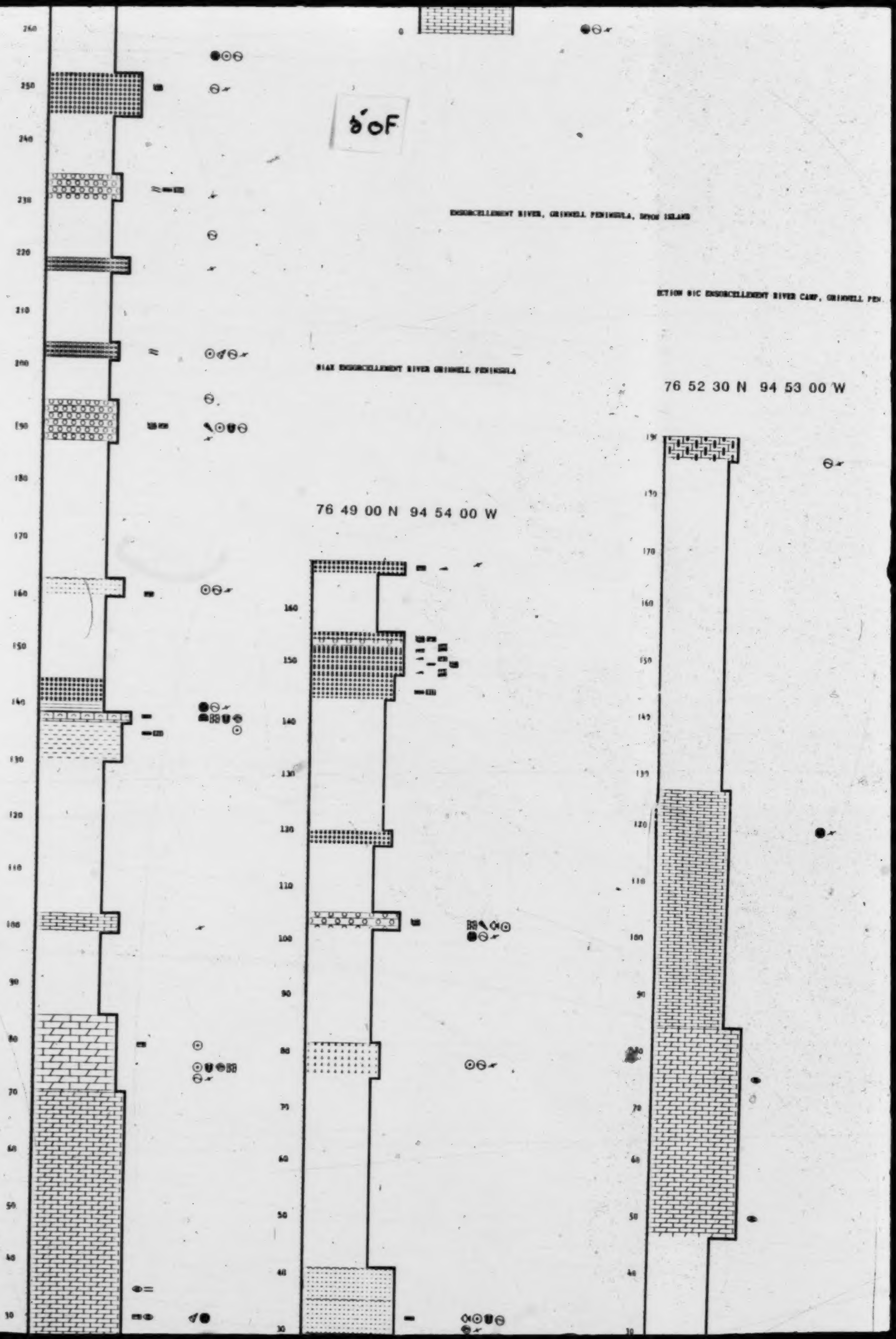
30F



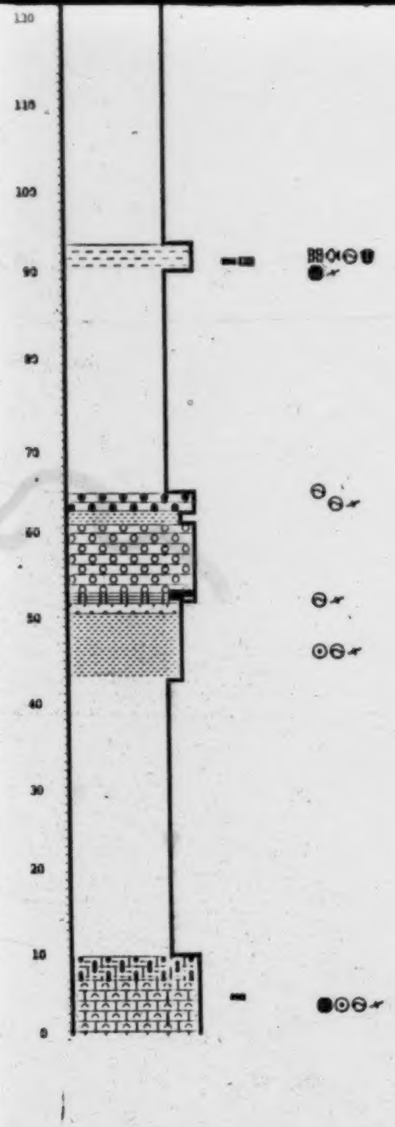


4 of

8'OF


ENSORCELLEMENT RIVER, GRINNELL PENINSULA, DEVON ISLAND
ECTION 81C ENSORCELLEMENT RIVER CAMP, GRINNELL PEN.
76 52 30 N 94 53 00 W
81AX ENSORCELLEMENT RIVER GRINNELL PENINSULA
76 49 00 N 94 54 00 W
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
0

6oF

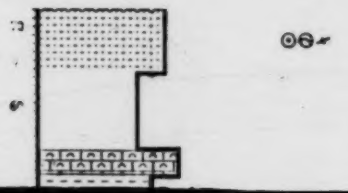


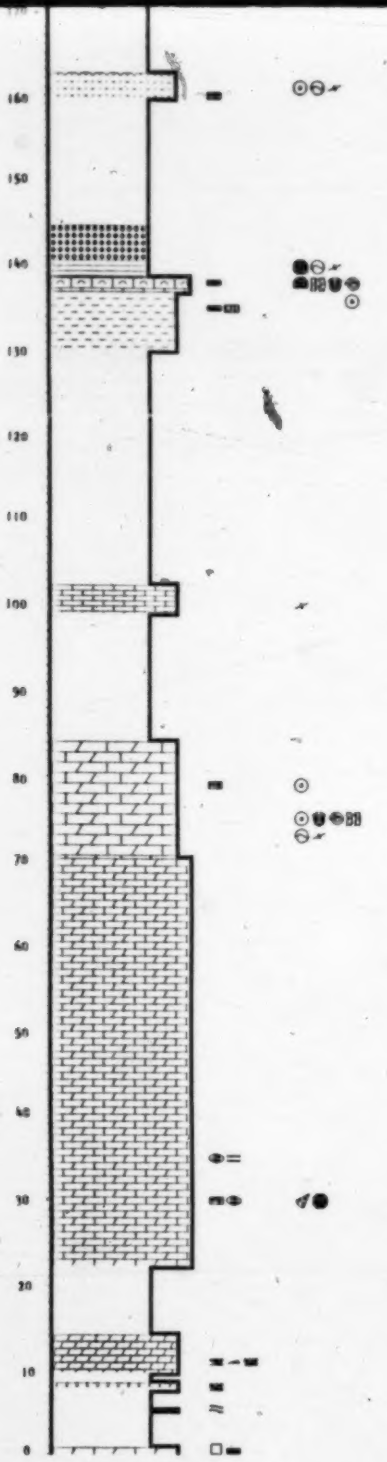
120
110
100
90
80
70
60
50
40
30
20
10
0

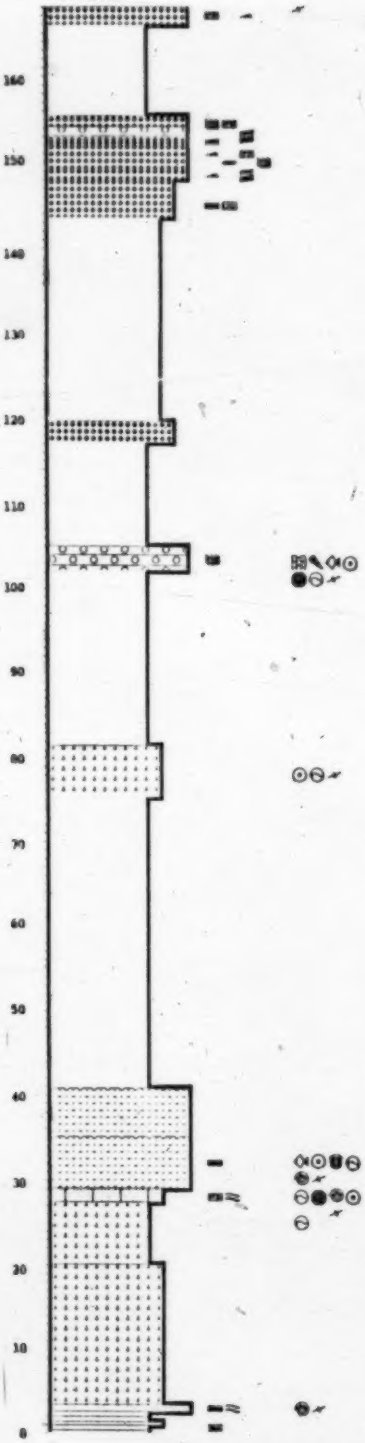
1981 B, TUCKER POINT GRINNELL PENINSULA DEVON ISLAND.

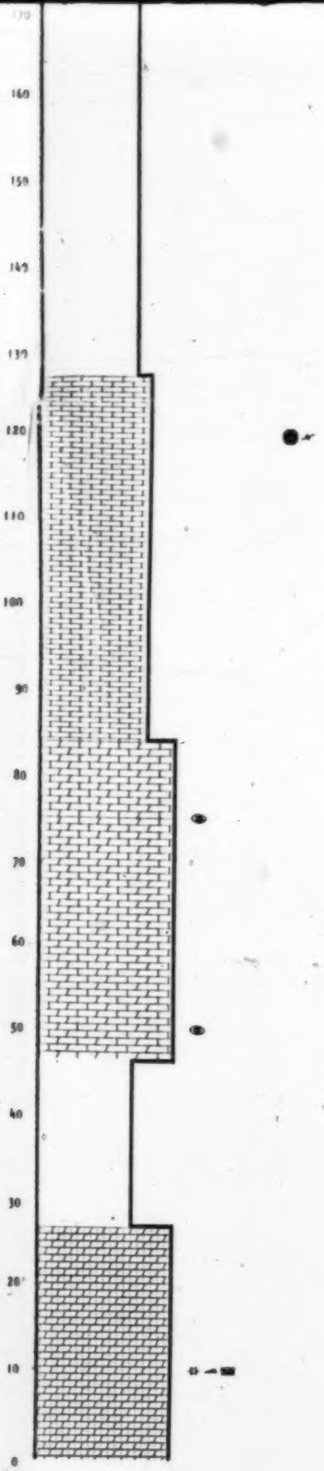
ECTION 1981 DE, TUCKER POINT, GRINNELL PENINSULA. Q.H. GOODBODY 1981

76 41 00 N 93 42 00 W




170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

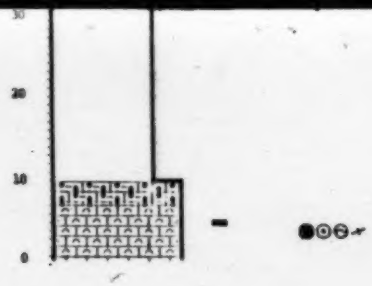

170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20'
10
0

7oF

81AB ENSORCELLEMENT RIVER GRINNELL PENINSULA

ECTION 81C ENSORCELLEMENT RIVER CAMP, GRINNELL PEN

GRINNELL PENINSULA

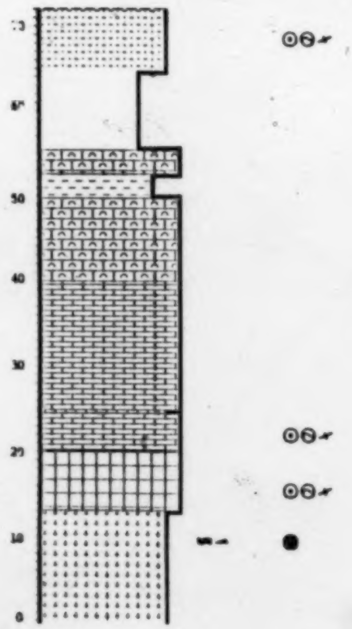


1981 D, TUCKER POINT GRINNELL PENINSULA DEVON ISLAND.

ECTION 1981 DE, TUCKER POINT, GRINNELL PENINSULA. Q.H. GOODBODY 1981

76 41 00 N 93 42 00 W

8 of 8


60
50
40
30
20
10
0

PEN.

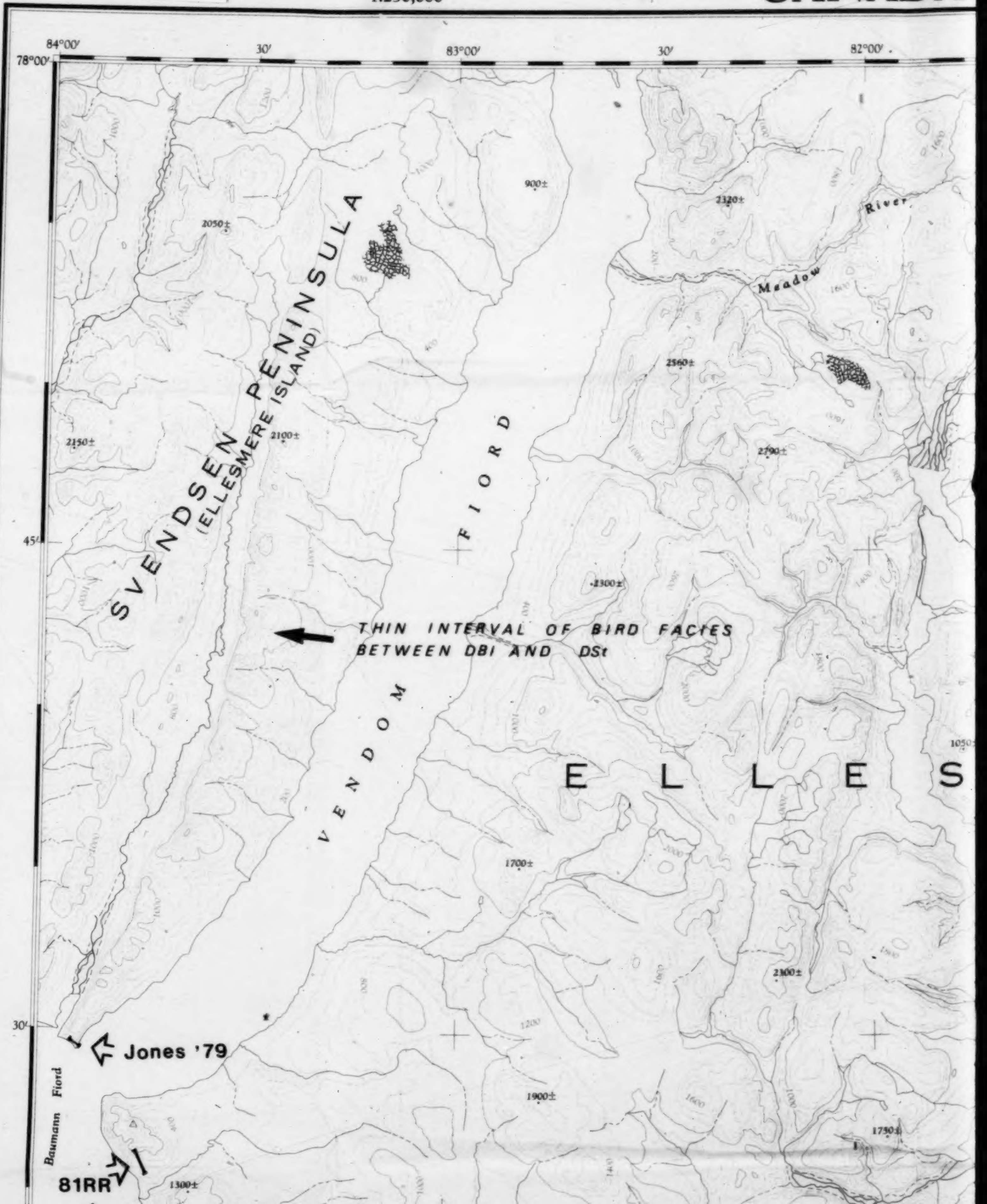
1981 DE, TUCKER POINT, GRINNELL PENINSULA. Q.H. GOODBODY 1981

49 D

1oF

1:250,000

CANADA

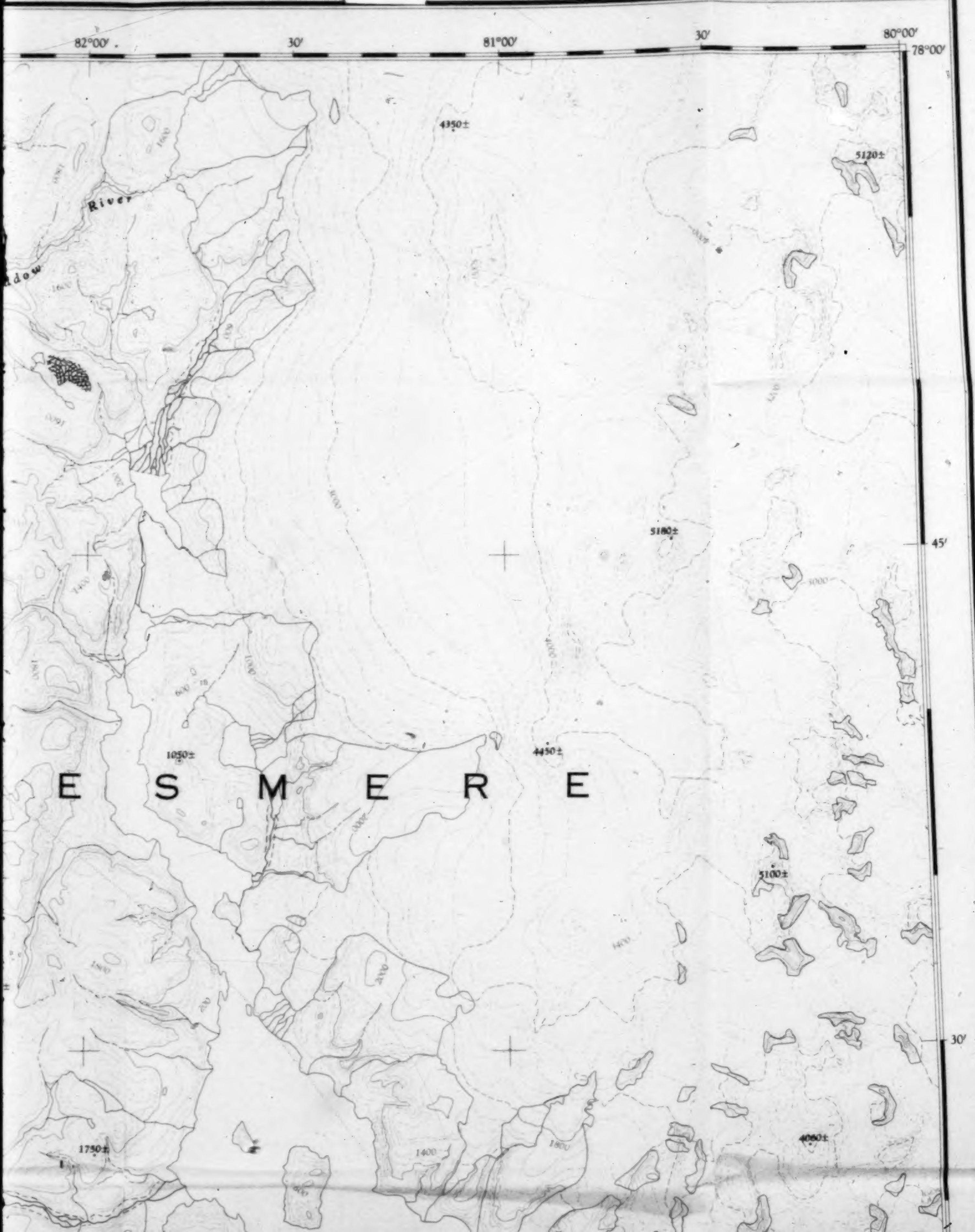

84°00′
30′
83°00′
30′
82°00′
78°00′
45′
30′
SVENDSEN PENINSULA
(ELLESMERE ISLAND)
VENDOM FIORD
ELLES
Meadow River
Baumann Fiord
2050±
900±
2320±
2560±
2150±
2100±
2790±
2300±
1700±
2300±
1900±
1750±
1300±
1050±
1000
1200
1400
1600
2000
800
400
200

THIN INTERVAL OF BIRD FACIES BETWEEN DBI AND DSt

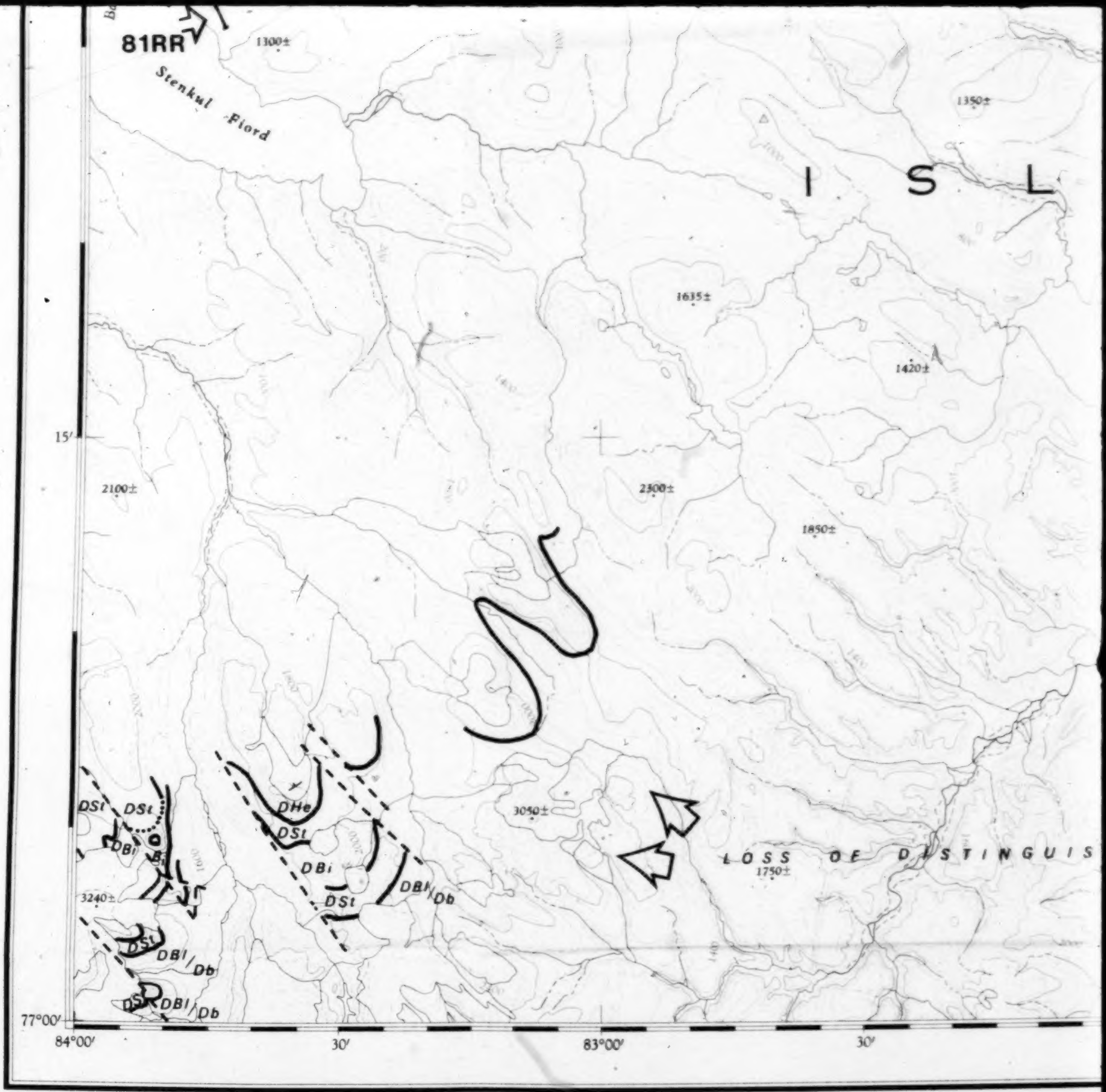
Jones '79

81RR

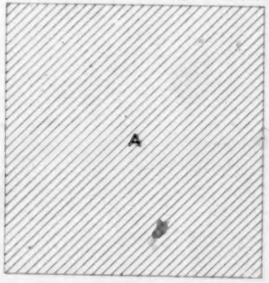
CANADA 20F EDITION 1 49 D


82°00'
30'
81°00'
30'
80°00'
78°00'
45'
30'
River
dow
1600
4350±
5120±
3000
5180±
4000
1400
1800
1050±
4450±
E S M E R E
2000
5100±
1750±
4060±

3oF


81RR
Stenkul Fiord
1300±
1350±
I S L
1635±
1420±
15′
2100±
2300±
1850±
3050±
LOSS OF DISTINGUIS
1750±
3240±
DSt
DSt
DBi
DHe
DSt
DBi
DSt
DBl/Db
DSt
DBl/Db
DS
DBl/Db
77°00′
84°00′
30′
83°00′
30′

RELIABILITY DIAGRAM · CROQUIS D'EXACTITUDE



A Compiled, photogrammetrically, from 1959 aerial photography.

A Rédigée photogrammétriquement d'après des photographies aériennes prises en 1959.

Produced, 1965-66, by the **SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES.** Field surveys 1961. Printed 1967.

The daily change of the North Magnetic Pole renders the magnetic compass unreliable in this area. Magnetic declination 1966 varies from 95°32′ westerly at centre of west edge to 90°19′ westerly at centre of east edge.

For complete reference see reverse side.

VENDO
DISTRICT
NORTHWES

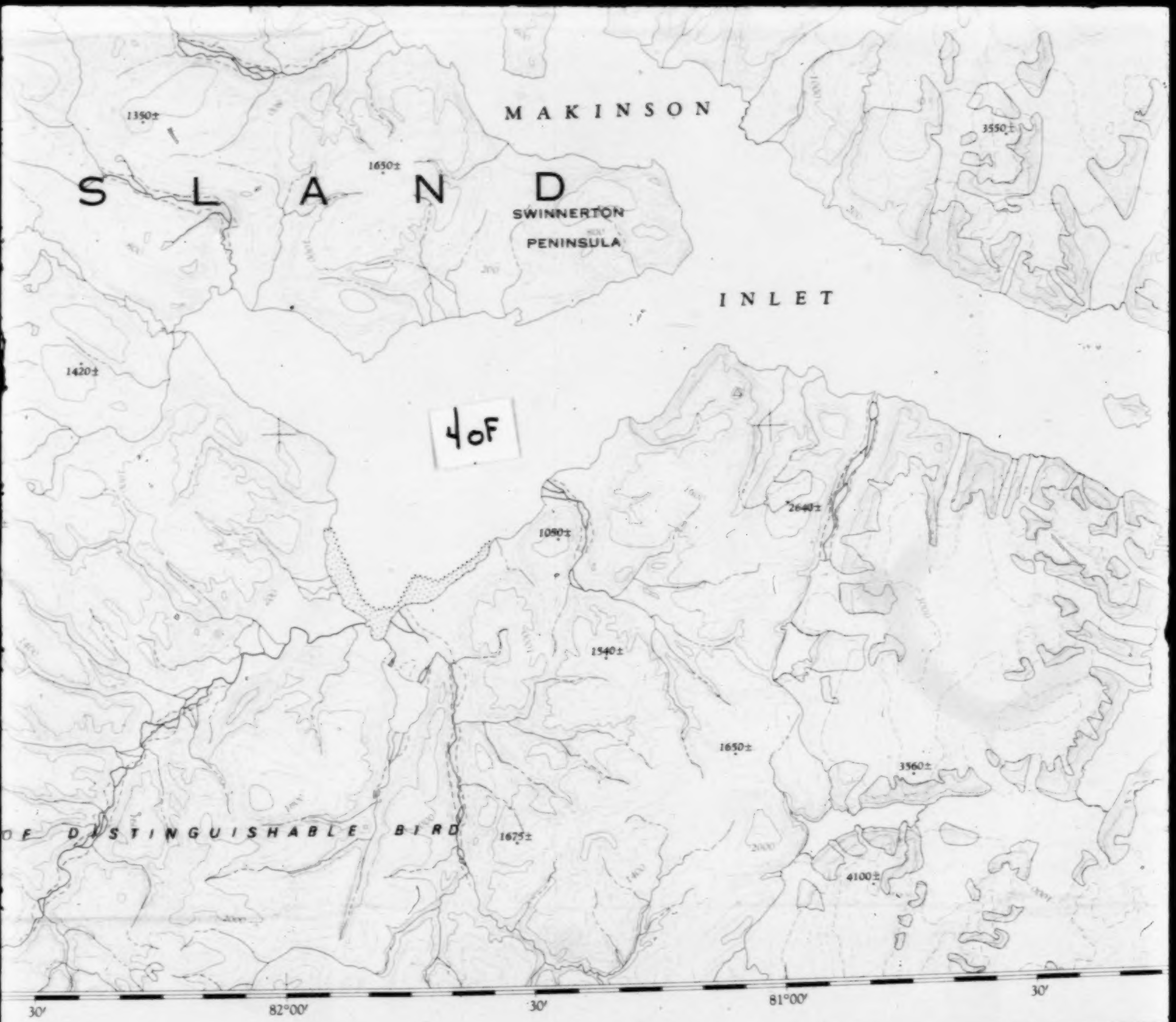
Scale 1:

Miles 5 0 5

Kilometres 5 0 5 10

Transverse Mercator Projection
North American Datum 1927
Contour interval 200 feet
Elevations in feet above Mean Sea Level

Copies may be obtained from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa.

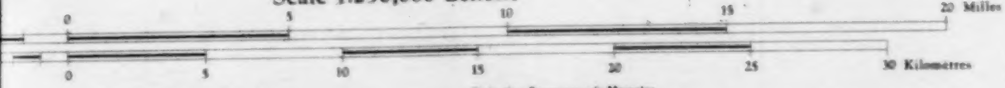

MAKINSON
INLET
SLAND
SWINNERTON
PENINSULA
1350±
1650±
1420±
3550±
1050±
2640±
1540±
1650±
3560±
1675±
4100±
OF DISTINGUISHABLE BIRD
30′
82°00′
30′
81°00′
30′

40F

VENDOM FIORD

DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES

Scale 1:250,000 Échelle


0
5
10
15
20 Milles
0
5
10
15
20
25
30 Kilomètres

Transverse Mercator Projection
North American Datum 1927
Contour interval 200 feet
Elevations in feet above Mean Sea Level.

Projection Transverse de Mercator
Niveau de référence nord-américain 1927.
Équidistance des courbes 200 pieds
Élévations en pieds au dessus du niveau moyen de la mer

Copies may be obtained from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa.

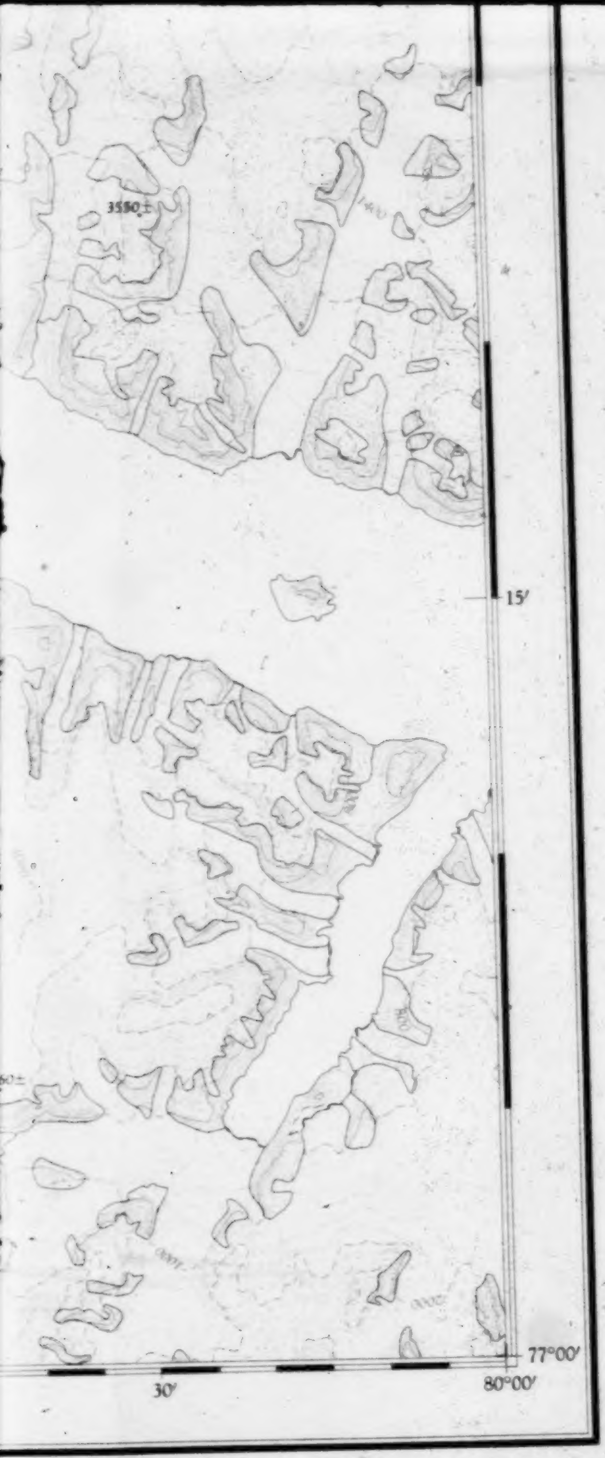
Ces cartes sont en vente au Bureau de distribution des cartes, ministère de l'Énergie, des Mines et des Ressources, Ottawa.

Établie en 1965-66, par la **DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES.** Levés sur le terrain en 1961. Imprimée en 1967.

La variation diurne du pôle Nord magnétique rend le compas magnétique peu sûr dans cette région. La déclinaison magnétique pour 1966 varie de 95°32′ Ouest au centre de la limite Ouest à 90°19′ Ouest au centre de la limite Est.

Pour une liste complète des signes, voir au verso.

79°
78°
77°
76°
88°


3550±
15′
77°00′
30′
80°00′

5of5

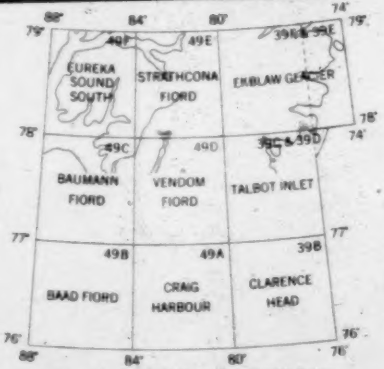
LEGEND

DHe	Hecla Bay Fm
DSt	Strathcona Fiord Fm
DBi	Bird Fiord Fm
DBl/Db	Blue Fiord/ Disappointment Bay Fm undifferentiated
⇨	measured section (meters)
....	covered contact
- - - - -	fault

ES LEVÉS ET DE LA CARTOGRAPHIE,
INES ET DES RESSOURCES. Levés sur le

...rd magnétique rend le compas
...te région. La déclinaison magné-
...'32' Ouest au centre de la limite
...tre de la limite Est.

...e des signes, voir au verso.

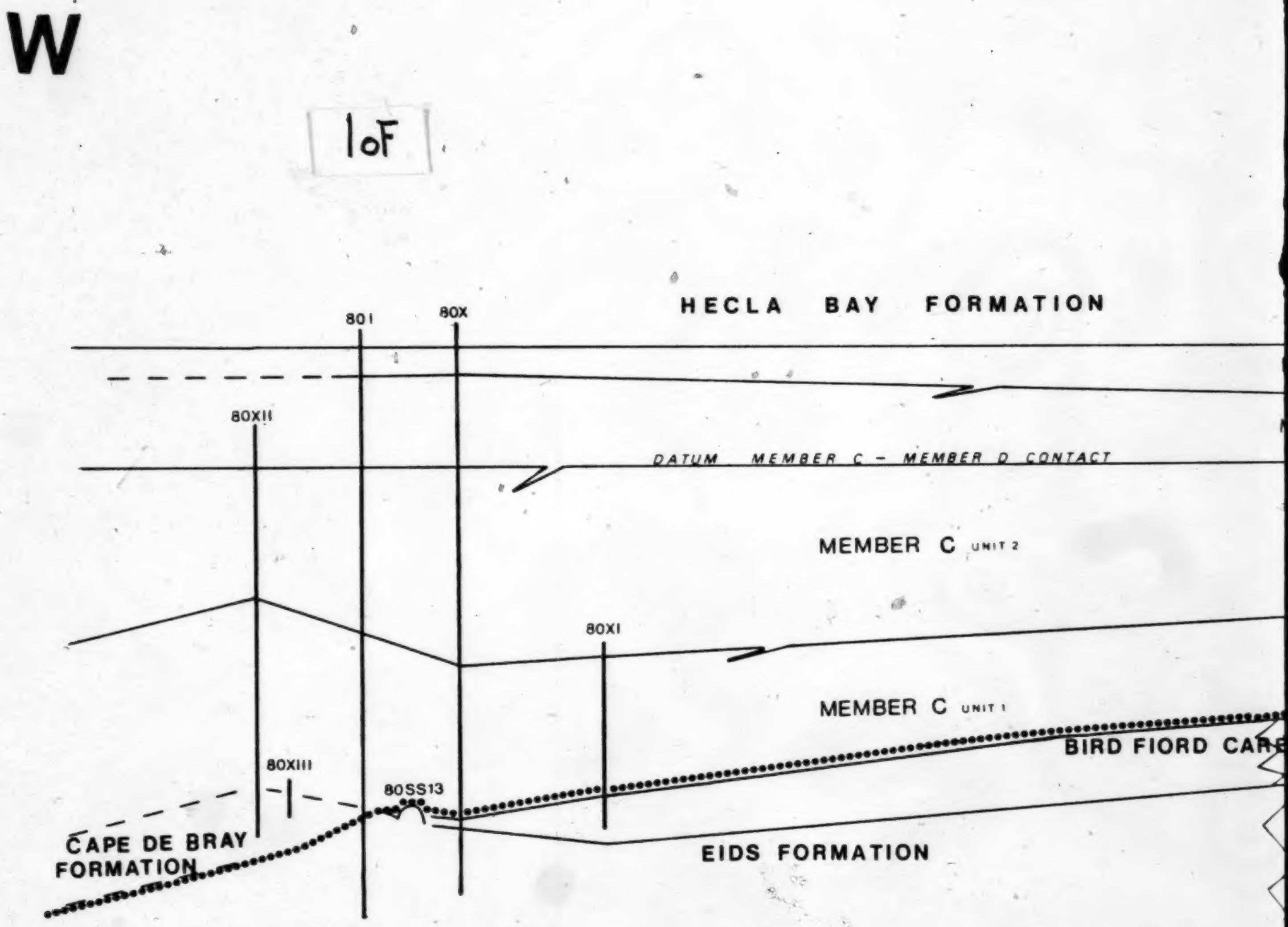

88°
84°
80°
74°
79°
49F
49E
39G & 39E
EUREKA SOUND/ SOUTH
STRATHCONA FIORD
EKBLAW GLACIER
78°
49C
49D
39C & 39D
BAUMANN FIORD
VENDOM FIORD
TALBOT INLET
77°
49B
49A
39B
BAAD FIORD
CRAIG HARBOUR
CLARENCE HEAD
76°

Index to adjoining sheets of National Topographic System

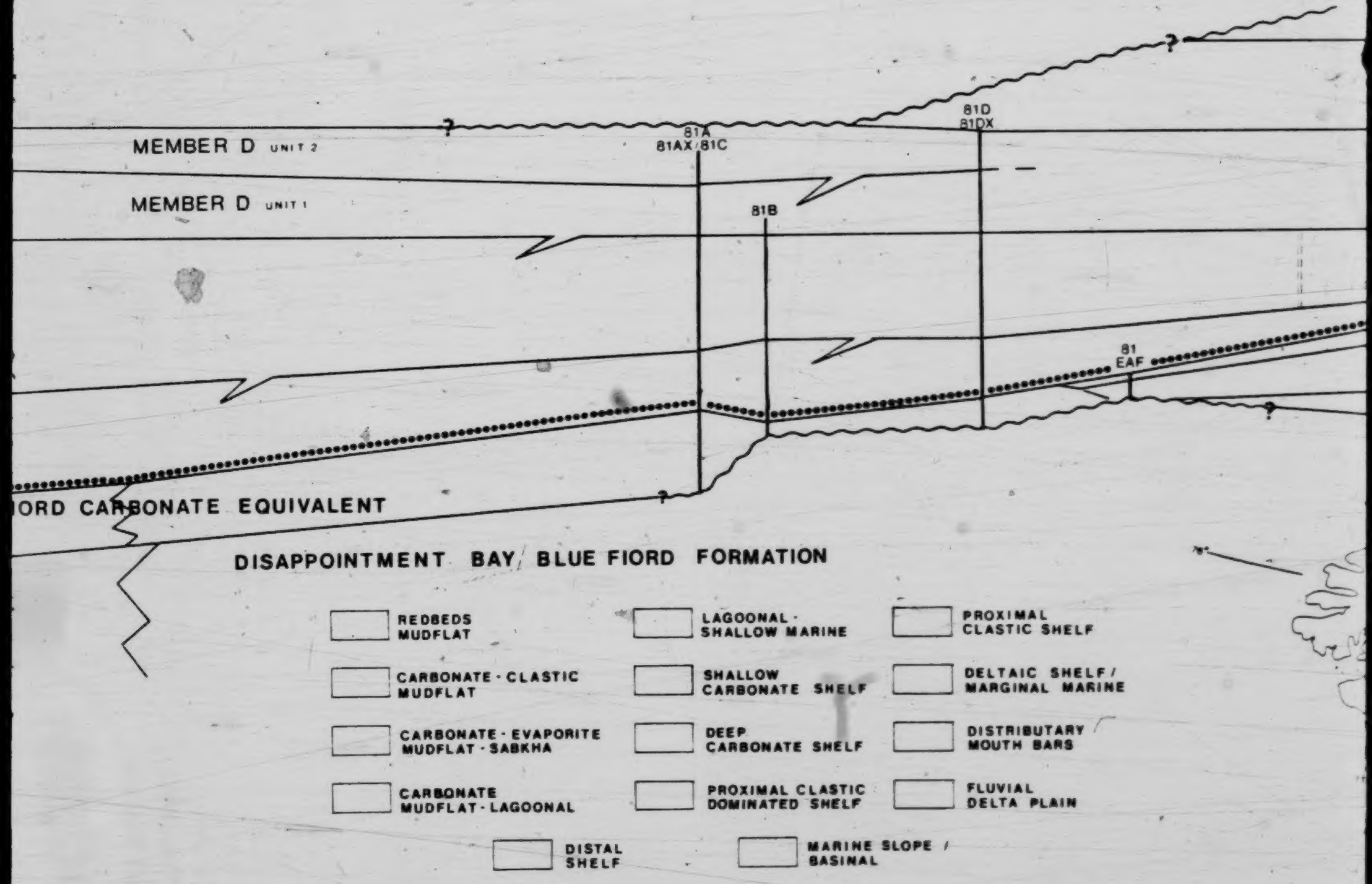
Tableau d'assemblage du Système national de référence cartographique

VENDOM FIORD
49D
EDITION 1

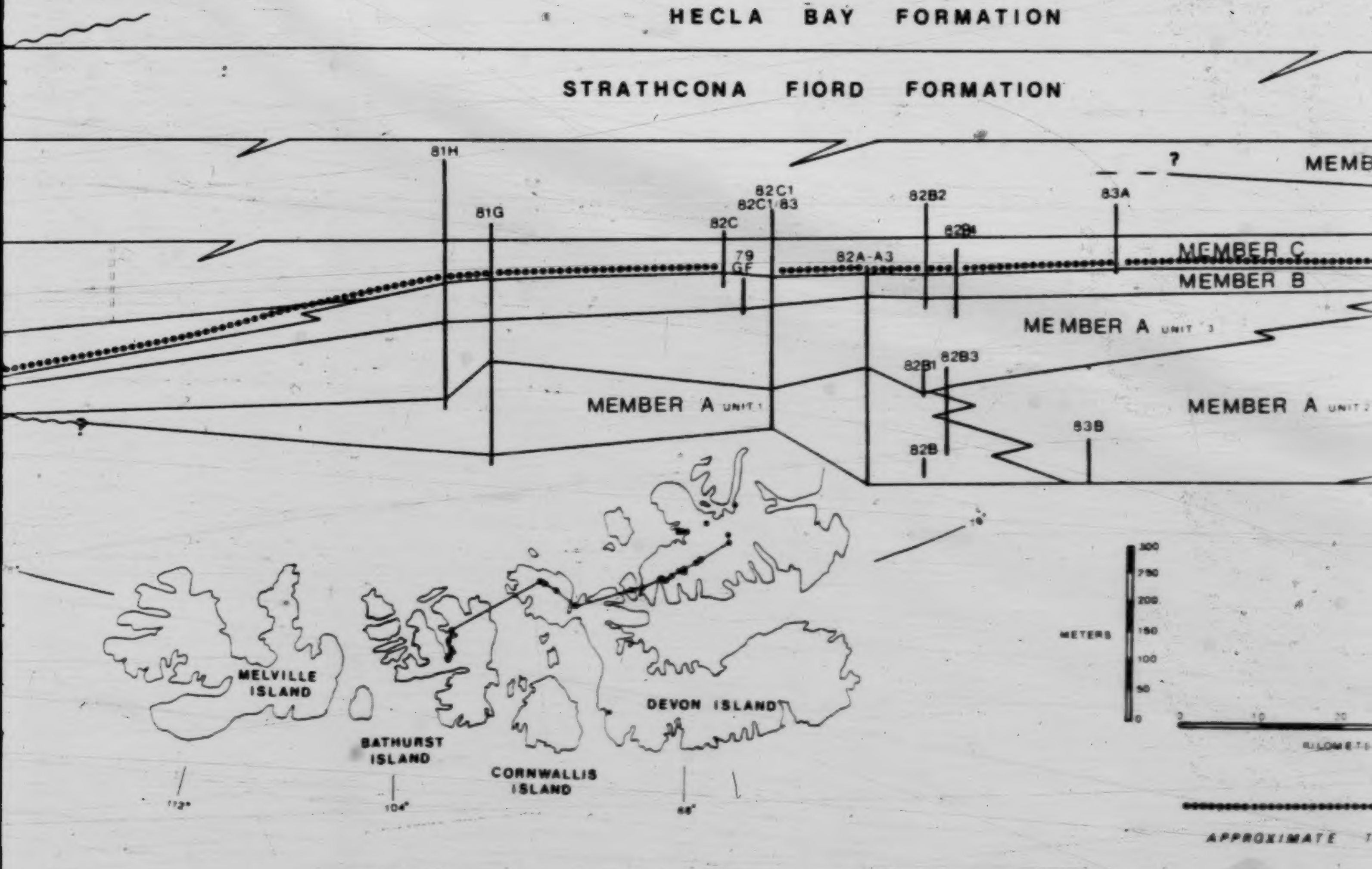
1oF


W
HECLA BAY FORMATION
80I
80X
80XII
DATUM MEMBER C – MEMBER D CONTACT
MEMBER C UNIT 2
80XI
MEMBER C UNIT 1
BIRD FIORD CAR
80XIII
80SS13
CAPE DE BRAY FORMATION
EIDS FORMATION

2oF


?
81A
81AX/81C
81D
81DX
MEMBER D UNIT 2
MEMBER D UNIT 1
81B
81
EAF
?
?
ORD CARBONATE EQUIVALENT
DISAPPOINTMENT BAY/ BLUE FIORD FORMATION
REDBEDS MUDFLAT
CARBONATE - CLASTIC MUDFLAT
CARBONATE - EVAPORITE MUDFLAT - SABKHA
CARBONATE MUDFLAT - LAGOONAL
LAGOONAL - SHALLOW MARINE
SHALLOW CARBONATE SHELF
DEEP CARBONATE SHELF
PROXIMAL CLASTIC DOMINATED SHELF
PROXIMAL CLASTIC SHELF
DELTAIC SHELF / MARGINAL MARINE
DISTRIBUTARY MOUTH BARS
FLUVIAL DELTA PLAIN
DISTAL SHELF
MARINE SLOPE / BASINAL

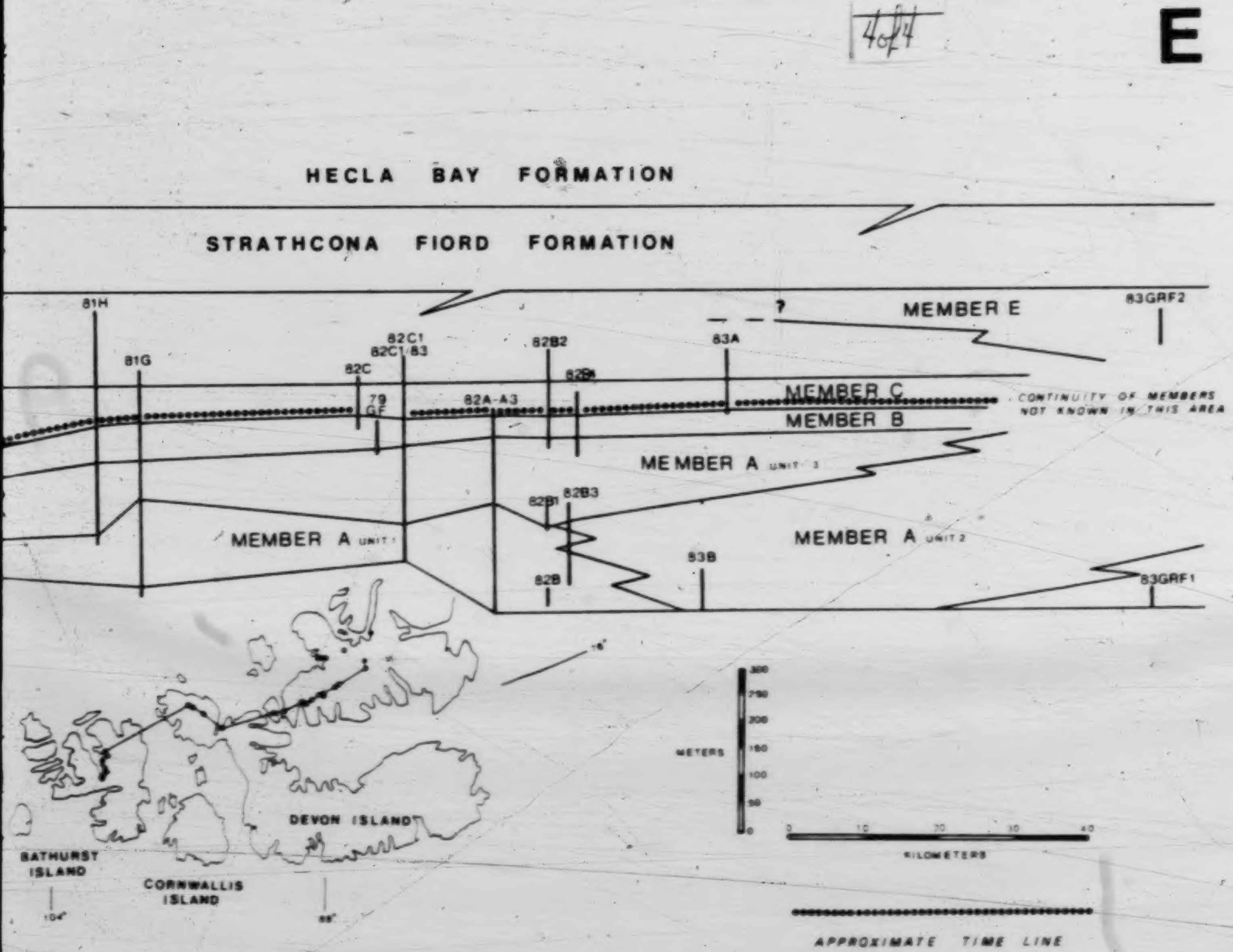
30F



HECLA BAY FORMATION
STRATHCONA FIORD FORMATION
81H
81G
82C
82C1
82C1/83
79
GF
82A-A3
82B2
82B4
83A
?
MEMB
MEMBER C
MEMBER B
MEMBER A UNIT 3
MEMBER A UNIT 1
82B1
82B3
82B
83B
MEMBER A UNIT 2
?
MELVILLE ISLAND
BATHURST ISLAND
CORNWALLIS ISLAND
DEVON ISLAND
112°
104°
88°
METERS
300
250
200
150
100
50
0
0
10
20
KILOMETE
APPROXIMATE T

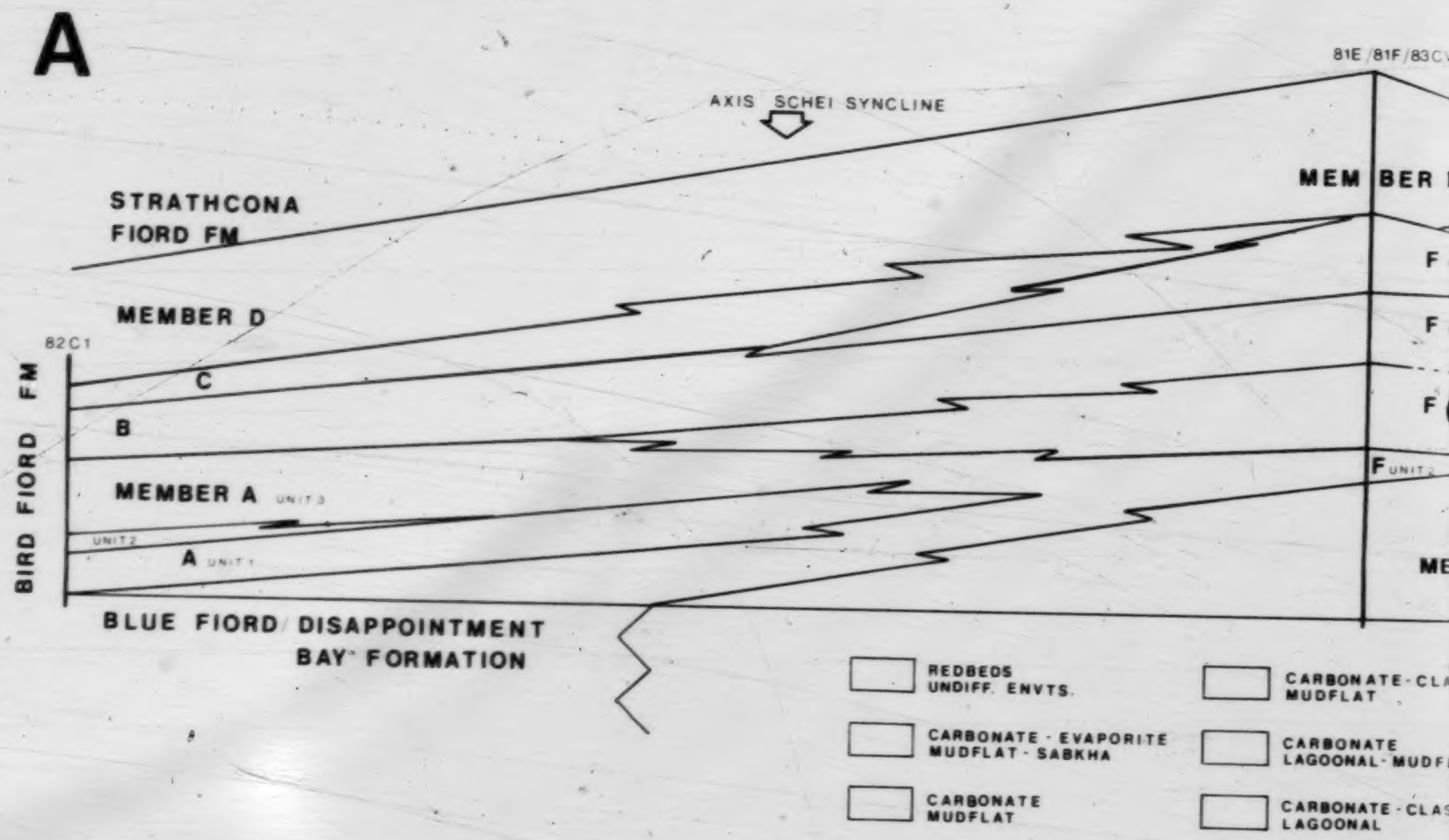
Text-Figure 7.1: Regional cross section; Bathurst Island to Ellesmere Island (south of Schei syncline)

4 of 4

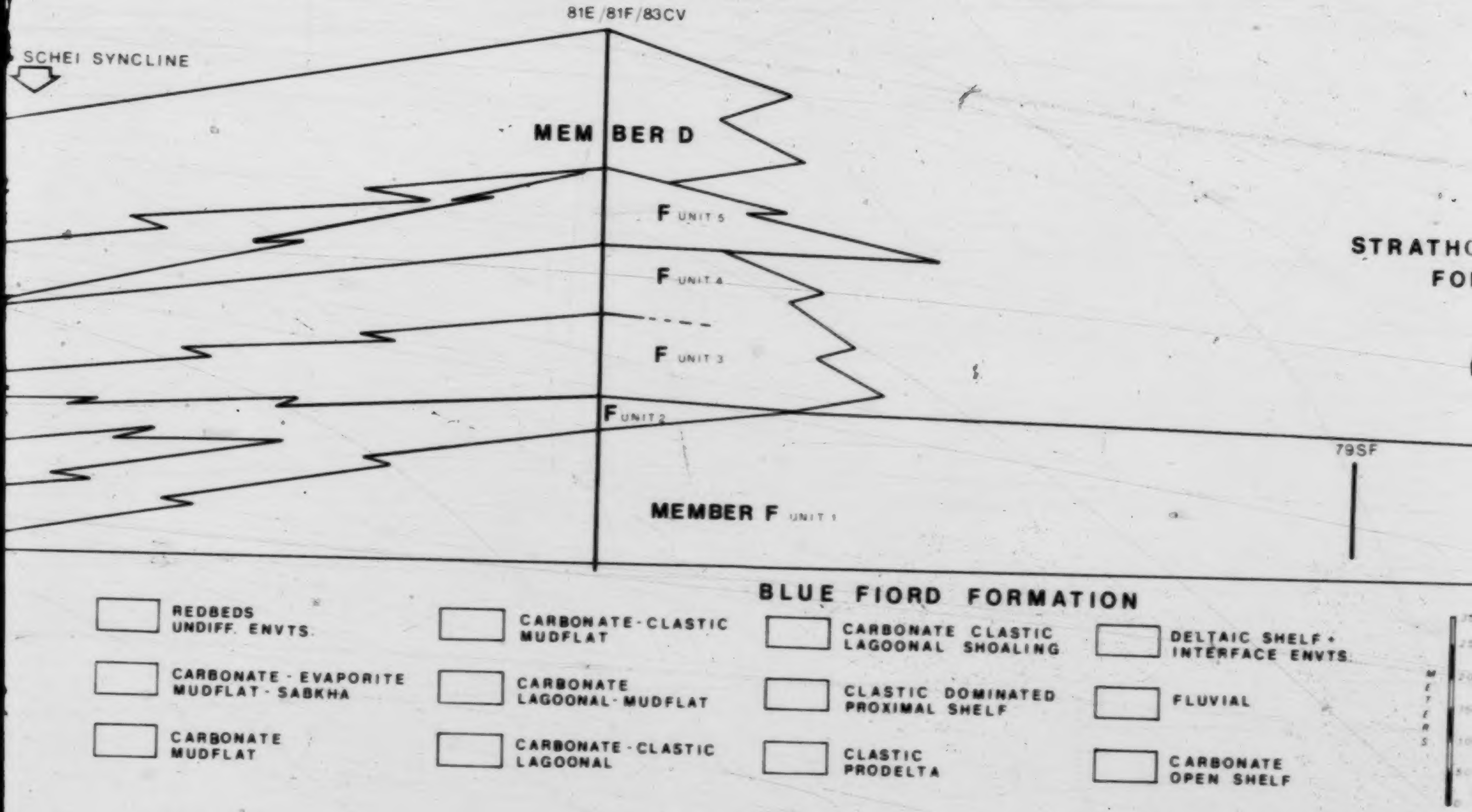

E
HECLA BAY FORMATION
STRATHCONA FIORD FORMATION
MEMBER E
?
83GRF2
81H
81G
82C1
82C1/83
82C
79 GF
82A-A3
82B2
82B4
83A
MEMBER C
MEMBER B
CONTINUITY OF MEMBERS NOT KNOWN IN THIS AREA
MEMBER A UNIT 3
82B1
82B3
MEMBER A UNIT 1
MEMBER A UNIT 2
82B
83B
83GRF1
76°
METERS
0
50
100
150
200
250
300
0
10
20
30
40
KILOMETERS
BATHURST ISLAND
CORNWALLIS ISLAND
DEVON ISLAND
104°
88°
APPROXIMATE TIME LINE

Text-Figure 7.1: Regional cross section; Bathurst Island to Ellesmere Island (south of Schei syncline)

1oF

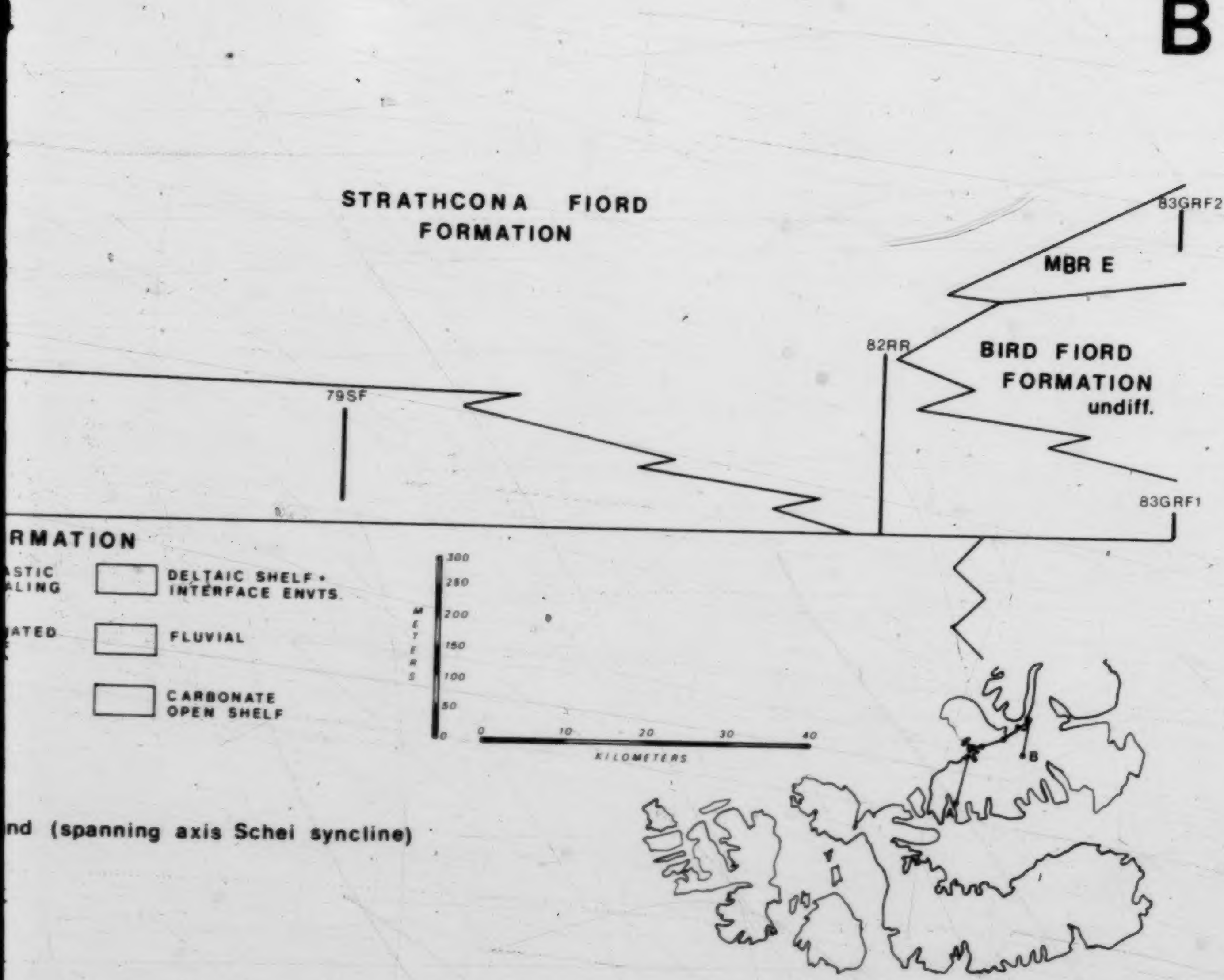

A
81E/81F/83C
AXIS SCHEI SYNCLINE
STRATHCONA FIORD FM
MEMBER D
MEM BER
82C1
C
B
F
F
F
BIRD FIORD FM
MEMBER A UNIT 3
UNIT 2
A UNIT 1
F UNIT 2
ME
BLUE FIORD/DISAPPOINTMENT BAY FORMATION
REDBEDS UNDIFF. ENVTS.
CARBONATE - EVAPORITE MUDFLAT - SABKHA
CARBONATE MUDFLAT
CARBONATE-CLA MUDFLAT
CARBONATE LAGOONAL-MUDF
CARBONATE-CLAS LAGOONAL

Text-Figure 7.2: Regional cro


81E /81F /83CV
SCHEI SYNCLINE
MEMBER D
F UNIT 5
F UNIT 4
F UNIT 3
F UNIT 2
MEMBER F UNIT 1
STRATH
FO
79SF
BLUE FIORD FORMATION
REDBEDS UNDIFF. ENVTS.
CARBONATE - EVAPORITE MUDFLAT - SABKHA
CARBONATE MUDFLAT
CARBONATE - CLASTIC MUDFLAT
CARBONATE LAGOONAL - MUDFLAT
CARBONATE - CLASTIC LAGOONAL
CARBONATE CLASTIC LAGOONAL SHOALING
CLASTIC DOMINATED PROXIMAL SHELF
CLASTIC PRODELTA
DELTAIC SHELF + INTERFACE ENVTS.
FLUVIAL
CARBONATE OPEN SHELF
METERS

Text-Figure 7.2: Regional cross section, Ellesmere Island (spanning axis Schei syncline)

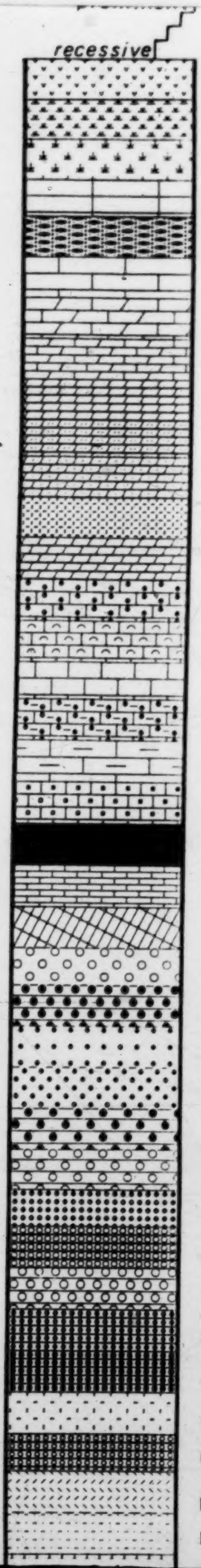
30F



B
STRATHCONA FIORD FORMATION
83GRF2
MBR E
82RR
BIRD FIORD FORMATION undiff.
79SF
83GRF1
RMATION
ASTIC
ALING
DELTAIC SHELF + INTERFACE ENVTS.
ATED
FLUVIAL
CARBONATE OPEN SHELF
METERS
300
250
200
150
100
50
0
0
10
20
30
40
KILOMETERS
A
B

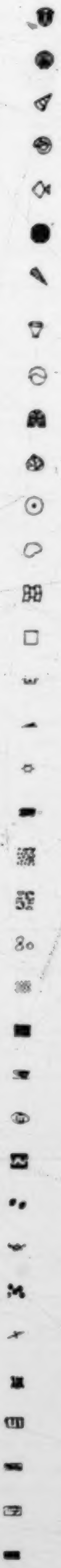
nd (spanning axis Schei syncline)

1oF

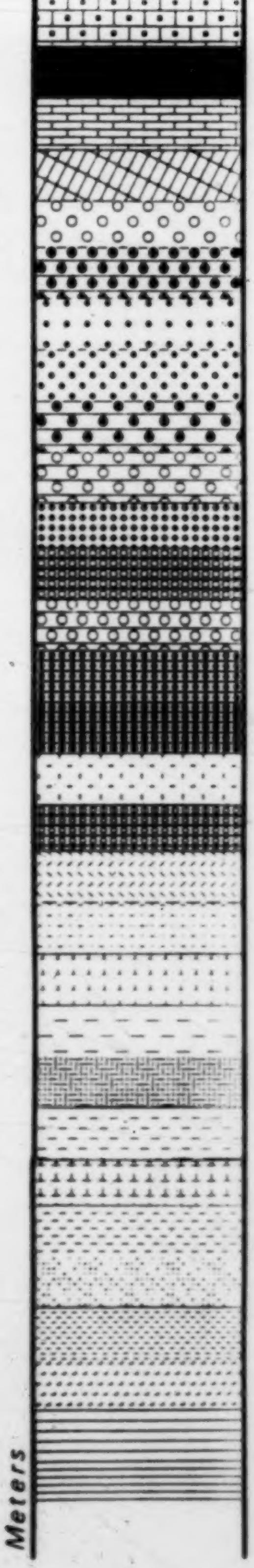


WEATHERING PROMINENCE

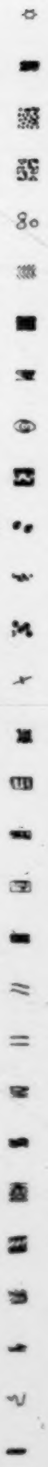
- GYPSIFEROUS SILTSTONE
- GYPSIFEROUS SHALE
- GYPSUM
- MASSIVE DOLOMITIC LIMESTONE
- RUBBLY DOLOMITIC LIMESTONE
- PLANAR BDED. DOLMTC. LST.
- DOLOSPARITIC LIMESTONE
- MICRITIC DOLMTC. LIMESTONE
- MICRITIC DOLOMITE
- SANDY DOLOSTONE
- SILTY DOLOSTONE
- MASSIVE SUCROSIC DOLOSTONE
- DOLOSTONE
- RUBBLY SANDY LIMESTONE
- RUBBLY SILTY LIMESTONE
- SILTY LIMESTONE
- RUBBLY ARGILLACEOUS LST.
- ARGILLACEOUS LIMESTONE
- RUBBLY MICRITIC LIMESTONE
- CORAL BIOSTROME
- MICRITIC LIMESTONE
- ALGAL LIMESTONE
- CONGLOMERATE
- RED SANDSTONE
- KAOLINITIC SANDSTONE
- FINE-MEDIUM GRAINED SST.
- RUBBLY CALCAREOUS SANDSTONE
- CALCAREOUS FINE GRAINED SST.
- NON-CALCAREOUS FINE SANDSTONE
- RUBBLY CALC. SILTY SANDSTONE
- CALCAREOUS SILTY SANDSTONE
- NON-CALCAREOUS SILTY SST.
- ARGILLACEOUS SANDSTONE
- RUBBLY SILTSTONE
- COQUINOID SILTSTONE
- DOLOMITIC SILTSTONE
- RUBBLY CALCAREOUS SILTSTONE



- TRILOBITE
- BIVALVE
- GASTROPOD
- NAUTILOID
- FISH
- CORAL
- TENTACULITID
- SPONGE
- BRACHIOPOD
- STROMATOPOROID
- PLANT FRAGMENT
- CRINOID OSSICLE
- OSTRACOD
- BRYOZOAN
- MASSIVE BEDS
- BALL AND PILLOW
- RIPPLE
- MUDCRACK
- INTERFERENCE RIPPLES/CURRENT BEDDED
- BRECCIA
- BRECCIA
- VUGS
- HERRINGBONE CROSS BEDDING
- HERRINGBONE CROSS LAMINATION
- CHANNELLING
- BIRDSEYE TEXTURE
- ENTEROLITHIC FABRIC
- HALITE PSEUDOMORPHS
- RIP UP CLASTS
- CALCISPHERES
- BIOCLASTIC MATERIAL
- STROMATOLITE
- VERTICAL BIOTURBATION
- HORIZONTAL BIOTURBATION
- BIOTURBATION UNDIFFERENTIATED
- PLANAR LAMINATION



RUBBLY MICRITIC LIMESTONE
CORAL BIOSTROME
MICRITIC LIMESTONE
ALGAL LIMESTONE
CONGLOMERATE
RED SANDSTONE
KAOLINITIC SANDSTONE
FINE-MEDIUM GRAINED SST.
RUBBLY CALCAREOUS SANDSTONE
CALCAREOUS FINE GRAINED SST.
NON-CALCAREOUS FINE SANDSTONE
RUBBLY. CALC. SILTY SANDSTONE
CALCAREOUS SILTY SANDSTONE
NON-CALCAREOUS SILTY SST.
ARGILLACEOUS SANDSTONE
RUBBLY SILTSTONE
COQUINOID SILTSTONE
DOLOMITIC SILTSTONE
RUBBLY CALCAREOUS SILTSTONE
CALCAREOUS SILTSTONE
COARSE SILTSTONE
MICACEOUS SILTSTONE
SILTSTONE
ARGILLACEOUS CALC. SILTSTONE
ARGILLACEOUS SILTSTONE
MICACEOUS SHALE
SILTY SHALE
CALCAREOUS SILTY SHALE
CALCAREOUS SHALE
SHALE
COVERED INTERVAL



MUDCRACK
INTERFERENCE RIPPLES/CURRENT BEDDED
BRECCIA
BRECCIA
VUGS
HERRINGBONE CROSS BEDDING
HERRINGBONE CROSS LAMINATION
CHANNELLING
BIRDSEYE TEXTURE
ENTEROLITHIC FABRIC
HALITE PSEUDOMORPHS
RIP UP CLASTS
CALCISPHERES
BIOCLASTIC MATERIAL
STROMATOLITE
VERTICAL BIOTURBATION
HORIZONTAL BIOTURBATION
BIOTURBATION UNDIFFERENTIATED
PLANAR LAMINATION
WAVY BEDDING
PLANAR BEDDING
PLANAR TO WAVY LAMINATION
WAVY LAMINATION
DISTORTED LAMINATION
PLANAR CROSS BEDDING
TROUGH CROSS STRATIFICATION
ANTIDUNE
STYLOLITE
CURRENT LINEATION

2of2

SYMBOLS KEY